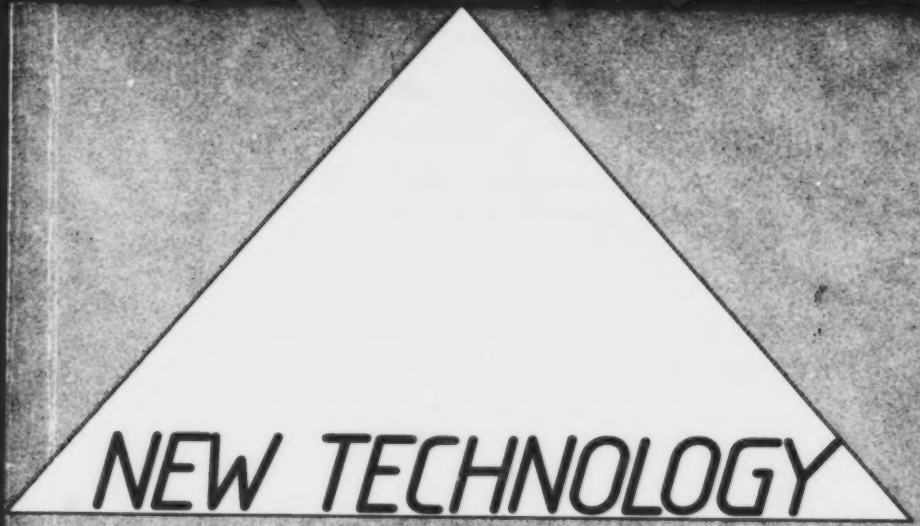

CHALLENGE AND CHANGE IN THE PRAIRIE LABOUR MARKET

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NEW TECHNOLOGY IN THE PRAIRIES

New Technology in the Prairies

Edited by Kenneth J. Alecxe and
Graham F. Parsons

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Preface

TECHNOLOGICAL CHANGE: THREAT OR OPPORTUNITY

Ken Alecxe and Graham Parsons

In the 1980s the winds of technological change are blowing hard across the western industrialized world and into the Canadian prairies. Advances in the new technologies of information transmission and retrieval, micro-chip computerization and genetic engineering are already making major changes to the urban industrial economies. Yet the Canadian prairies, in their still rural, often agricultural settings, seem far removed from these sometimes distant societal shifts.

The Canadian Plains Research Center (CPRC) of the University of Regina is an organization dedicated to researching the issues of the Canadian Plains. In 1984, the Human Resource Advisory Group of the CPRC identified technological change as a critical issue of central concern to prairie residents. How would the approaching wave of technological change affect jobs, agriculture, the rural society or urban culture?

Two workshops were held in 1984 to focus upon the effects of technological change on the prairie labour force. The first workshop, held in Saskatoon involved leaders of industry, government and labour and identified a range of issues related to productivity, labour management, education and the overall thrust of public programming. The papers delivered at this session were published under the title: *Saskatchewan Labour Market: Issues, Policies, Opportunities for Change*, edited by Kenneth J. Alecxe and G. Wayne McElree. Proceedings 14. Regina: Canadian Plains Research Center, 1984.

On 29 and 30 October 1984 a broader prairie-wide conference was held in Regina on the subject of *New Technology: Challenge and Change in the Prairie Labour Market.* The following chapters of this book outline the wide variety of issues and options facing prairie residents. Technological change is identified as a visible and existent reality in the prairie economy and society.

Speakers addressed the outlook, the educational requirements and the options for management, labour and the public. Workshops enabled conference participants to question speakers and develop solutions and directions to manage change.

Throughout the discussions it was apparent that technological change could not be avoided. Trends underway elsewhere in North America could not be escaped. Increasingly, these changes were prerequisites for economic survival. The real fears of negative technological destruction and obsolescence were a central part of

the discussions. Yet technological change also brought forth the great opportunities of the day. It was critically important that decision makers not ignore such change, but rather, aggressively embrace the new technologies for their specific local and regional purposes. In the prairies it was apparent that technological development in and around the great natural resource industries was a major employment and economic opportunity.

It is hoped that the dialogue and discussion that emerged from the conference, the related workshops and these papers will assist in allowing the prairies, their peoples, governments and industries, to take maximum positive advantage of an era of change.

Ken Alecxe and
Graham Parsons
Regina, 1985

I

THE BENEFITS OF NEW TECHNOLOGY IN SASKATCHEWAN:
A PROVINCIAL GOVERNMENT VIEW

Gordon G. Currie

Introduction

Technology is a significant factor both in the quantity of jobs that will be available in the future, and in the quality of work life. Technology could bring great economic and employment benefits to the prairies. However, it also poses some potential threats, especially in the short term. The government of Saskatchewan views employment as a key topic and I want to present that view and what we are doing about it in the context of new technology.

Through a co-operative approach Saskatchewan can meet these opportunities and challenges, and direct them to meet the needs of the people of the province. The threats of rejecting new technology are much greater than those of accepting it and using it. Failure to integrate new technology into the Canadian economy could result in reduced competitiveness, lagging productivity, and ultimately, job losses. Insulating ourselves from the world economy and international trade is no answer for Canada, much less the prairies. Acceptance and use of new technology on the other hand, should lead to more jobs in the long run, higher real income and stronger international competitiveness.

Technological change will produce long term benefits spread widely among the population; however, those immediately affected adversely are often concentrated in a particular group of workers. One adverse affect may be short-term employment dislocation. To illustrate, Computer Aided Design can create temporary job dislocation for draftspersons, while word processors will slow the employment growth of typists.

Technology and Government

It is the goal of the provincial government to attempt to maximize the benefits of new technology, and to minimize the potential threats. The government of Saskatchewan recognizes that technology is an important ingredient for economic progress. This is not the only case for improving current export products but also for the development of new products. It is recognized that Saskatchewan can no longer rely upon its primary products alone. The province must diversify with new, value-added production.

Saskatchewan requires new technologies in manufacturing and processing which will provide new products of such quality and cost that they can compete on world markets. The future achievement of Saskatchewan in industry depends upon how people in this province can develop, transfer, utilize and exploit technology. The Department of Science and Technology was established to be the centrepiece of research and development of the province for the purpose of co-ordinating, facilitating, and supporting these activities.

Following is a description of the rise of new technology industry in the province of Saskatchewan. The number of new technology companies is increasing rapidly, and the use of new technology in business and industry is also increasing. Each new high technology company means more jobs for the people of this province. Less than a year ago, statistics compiled by a provincial task force headed by Alex Curran, President of SED Systems, showed that there were 2,478 employees in the 55 high technology companies in Saskatoon ("Partners in Economic Growth: High Technology Industry and Postsecondary Education," The Report of the Task Force on High Technology, November 1983). At that time the task force predicted that these private sector companies will increase in total staff by 93 percent over the next five years.

Following are a few examples of the rapid growth of high technology companies based in Saskatchewan. Develcon, in Saskatoon, a company that specializes in switching devices in the computer networks has just announced a $5 million sale to NASA. Also, SED Systems, which specializes in communications technologies, has announced a $25 million contract with the Canadian Department of National Defense. A contract of this proportion will provide 250 person-years of employment. In a different league, but also extremely important in adding to the labour force and economy, is a new company called Spectron. It supplies computer software and services to the trucking industry. A year ago they started with two people and now they have fourteen employees.

In recent months there have been eighteen new high technology firms start up in our province. Not only are there new companies being established — some as spin-offs from larger companies — but there is considerable interest in reputable firms from eastern Canada and the United States who wish to relocate in Saskatchewan. This activity is not confined to the urban areas of Saskatoon and Regina. One advantage for the prairies is that high technology firms do not need a preferred location next to urban markets in order to thrive. Therefore, a number of companies have sprung up in low cost rural areas. In Estevan there is a manufacturing company called Eurotech doing research in the soil residuals fertilizers field. In Kindersley there is CAPA, a defence software company. There is also a company in Kerrobert

called CanCarbon, which is manufacturing activated charcoal products from waste grain. Pharmatech, which is located in Big River, develops pharmacy software.

The provincial government encourages and supports new technology companies by a variety of programmes. Our Department of Science and Technology, for example, provides contract monies for research and development of new products. This department tries to maximize the federal funding that is available; and through cost-shared agreements with the federal government, we develop programmes to assist industry and provide a climate of innovation.

Other departments have some very interesting incentives for the entrepreneur. The provincial government recognizes the need to have an available pool of trained personnel, as well as programmes for upgrading and retraining. One illustration of this recognition has been the creation of the Advanced Technology Training Centre at the Kelsey Institute of Applied Arts and Sciences in Saskatoon. This centre should ensure that ongoing upgrading and retraining is available to workers in the high technology industries. Industry and government are co-operating in the establishment and operation of this training centre. This centre will adapt its training and retraining programme to meet the changing needs forecast by industry and labour in the advanced technologies.

The growth of high technology manufacturing and the subsequent increase of technical and professional employment are undoubtedly the most positive aspects of new technology. But there are other issues that must be addressed: these include the effects of new technology on the existing industries, the education and training to prepare youth and the existing work force for changing occupations, and the quality of working life. It is necessary to assess the effects that technology is having on our lives, the effects it will have in the future and how we can shape it to serve our needs.

In order to conduct an appropriate assessment we require information and research data. A great deal of information comes from the media. However, most of the media coverage tends to sensationalize the advent of the information age. Very frequently the focus has been on the down side, with an emphasis on such issues as job dislocation from the introduction of robotics. While job dislocation is a real issue, much of the information that we get about this issue is relevant to an economic environment different from the prairies. The effects of technology in Sarnia, Windsor and Detroit will be quite different from effects on the prairie economy. Research has been initiated by the Human Resource Advisory Group at the Canadian Plains Research Center which is relevant to the impact of new technology in all three prairie

provinces. The results of this research and the discussion it generates will be timely, given the need for concrete, objective research data.

What are the many things we have to know in order to meet the challenge of change in the information society? In introducing new technology to existing industry, we need to know what is taking place elsewhere in the world so that we can remain competitive. We need to know what the quantitative and qualitative effects of that technology might be on employment. It is important that we know where new jobs might emerge or be created as a result of adopting technology so that job dislocation is minimized. In training our youth and the work force we need to know what skills will be needed, so that we will not have to import skilled labour to the prairies. In enhancing the quality of work life we must be aware of the implications of the new technology for the physical, social and psychological health of the Saskatchewan labour force.

The main negative effects of new technology have been found in the social and psychological health areas. Fears and uncertainties arise about the loss or downgrading of jobs, the skill requirements of new and unfamiliar occupations and the loss of a familiar work environment. There are internal department plans for minimizing the anxieties and the dislocation. However, in order to reduce the psychological impact, and to maximize the benefits of new technology, it is necessary that all the actors contribute to the solution — labour, industry, government, education. As a result, representatives at workshops such as this one can contribute immensely to the realization of the benefits that new technology can bring to Saskatchewan.

II

NEW TECHNOLOGY: GLOBAL OPPORTUNITY, LOCAL CHALLENGE

David John Seel, Jr.

Introduction

Canadians have expressed themselves. They are ready for change. And while we cannot be certain that the future of the Canadian Plains will be better, it is certain that it will be different. This difference comes less from the recent changes in Ottawa, as from the fundamental changes that are shaping the context of our world. One cannot afford to ignore this context. These forces of change confront every nation, every region, every business, and every individual with new challenges and opportunities.

These forces of change do not heed national boundaries. As a consequence, the future of this region differs little from the future of the American Great Plains. The Naisbitt Group looks to certain bellwether regions as leaders in response to these forces. The concept of a bellwether is a helpful one for our purposes. There are certain regions which we have found tend to lead in innovation. The United States looks to Florida, California and Texas. Watching activity in these regions is a way of anticipating future trends. Florida, for example, has the same demographic mix of old and young that will characterize the rest of the United States in ten years. How Florida faces the problem of maintaining quality public education, with large numbers of senior citizens who do not have an interest in this issue, will be instructive to other states.

Understanding these forces is not a matter of gazing into a crystal ball. John Naisbitt refuses to be called a "futurist." He calls himself a "nowist." This is because he believes that the best foresight into the future is derived from insight into the present. The Naisbitt Group gains this insight by studying local newspapers as a barometer of changing social concern. It is commonly believed that trends begin in places like New York, Washington or Ottawa because of the national media focus on these cities. The Naisbitt Group has found that trends begin locally in much smaller communities. What is going on in Canada is not what is going on in Ottawa. The really important trends begin where the people are. Trends start at the bottom. Look to cities like Tampa, Portland, Austin and San Antonio for creative leadership. Cities like Calgary and Regina and Winnipeg play a similar role in Canada.

The Economic Climate

The driving economies of the future will not be those of the past. The United States has undergone a major economic transition — as fundamental as when years ago we shifted from an agricultural to an industrial-based economy. Canada is faced with the same transition. In 1900, 90 percent of the United States work force was engaged in agriculture. Today 3 percent of that work force produces 125 percent of the United States' agricultural needs. In the 1960s, roughly 65 percent of the United States work force was involved in manufacturing goods. David Birch, a noted economist at Massachusetts Institute of Technology, states that as of June 1983 that number has dropped below 17 percent. Seventy percent of United States workers are involved in the management, processing and dissemination of ideas. For the first time in industrial history, ideas are the most valuable factor of production — the strategic resource — just as land and capital were in the past.

There are a number of common myths of what it means to be in an information economy. The first myth is that we will necessarily abandon the older "smoke stack" industries. The truth is that while they will not be abandoned, fewer workers will be employed by them. It has been suggested that by the year 2030, the manufacturing sector of the United States economy will employ only 3 percent of the work force, the same number of workers as are engaged in agriculture today. General Motors' strategy is characteristic of United States auto manufacturers. They are going to buy more parts abroad, accelerate automation and shrink employment further, buy high-tech companies to enhance know-how, import Japanese sub-compacts for sale as General Motors models and produce compacts in the United States through joint venture with Toyota. It is a two-fold strategy. They are exporting and automating production.

Every manufacturing company is faced with similar choices. Yet it is no different in Silicon Valley — the heart of the new information renaissance. Very vew silicon chips are made in this country and very few computers. Those that are, like Apple's Macintosh, are produced in plants so automated that thousands of computers are assembled by a few dozen workers. What remains in the Silicon Valley — and what will be the strategic economic activity of the future — are the people with ideas.

Local governments are also being forced to adopt a similar strategy. Owing to tight fiscal policies, municipal services are being exported to the private sector. Houston is an example of such privatization. In addition, office automation will have a greater impact on future white-collar employment than robotics will in blue-collar work. This is owing to the number of white-collar jobs. The number of white-collar workers grew three times as fast

as the number of blue-collar workers over the past twenty years. They now constitute 52 percent of all jobs compared to 32 percent in blue-collar occupations. Computers provide a means of cutting costs. Many local governments have been slow in using computer and office automation technology. As they do we expect to see the same process that has been observed in business — a shrinking of middle-level management. The analysis and preparation of data, a principal function of middle managers, will simply no longer be needed as electronic hardware invades executive offices. Technology will be a key factor in restructuring corporate structures.

The second myth of an information economy is that high-tech industries will be a major source of new jobs. This, too, is just not true. Only 6 percent of the work force will be working for high-tech firms in the next decade, according to the United States Bureau of Labor Statistics.

These two facts raise two questions: Where will the jobs of the future be located? And what specific training will these future workers need to prepare them for these jobs? A partial answer is found in observing the potato market. Potatoes are usually not considered a growing market. Potato farming is not a usual career option parents suggest to their children. But potatoes suggest a valuable lesson. Have you noticed what has been happening with potatoes recently? They have become a gourmet food. Gourmet French fries are the rage in Manhattan. Frankly Fries just opened an outlet a block from the Capitol in Washington. Wendy's introduced baked potatoes into their menu last October and they now sell 600,000 potatoes every day!

The lesson to learn is that future jobs will not be in the production of goods, but in their creative use. Persons like George Washington Carver are a model for today. The son of a slave, who had very little, took the humble peanut and developed hundreds of marketable uses. Ideas are the new economic resource. The creative uses of products are the new economic potential.

What does this mean practically? How does one prepare for this new reality? No one doubts the importance of being competitive in high-tech industries. Technology is a key to economic security. Corporate expenditures for research and development will need to be expanded. Commitment for the training of scientists, engineers and computer specialists must be maintained. However, such specialists will not constitute the bulk of the future work force. The training needed for the majority of the work force differs. Computer literacy and technical training are much less important for most new job entrants than a good education in reading, reasoning and other basic skills — a point emphasized in a recent study by the United States National Academy of Science. The strategy for developing more technology and for creating more jobs is not always the same. While technology acts as a founda-

tion for other economic activity, the skills needed to build on that foundation — to exploit the opportunities technology creates — are not the same. Long-term economic growth will necessitate a dual strategy: technological research and practical market applications.

There is also a new economic focus. Here the key word is polarization. National economies no longer exist. There are only local economies and global economies. In fact, the concept of a national economy is really an oxymoron: two words put together that contradict each other.

Local economies are based on regional distinctiveness. Regional differences need to be appreciated. The Canadian Plains are not the same as Québec or British Columbia. Every region has a distinct history, a distinct economy and distinct dreams. It will also have distinctive challenges and opportunities.

Increasingly, local communities are developing a global orientation. The Canadian Plains have had a global orientation for many years. Their extractive industries —agriculture, oil, mining, and forestry — are dependant on global markets. Exports account for more than a quarter of Canada's economic output, compared with less than 9 percent for the United States. It is clear that in spite of the attempted mouth-to-mouth resuscitation by old industrialists and political candidates, protectionism is dead. We will either compete globally, or we will not compete locally. Protectionism may have been a meaningful concept in the 1950s when the United States had 6 percent of the global population and 40 percent of the global Gross National Product, but today the situation is quite different. While the United States still has 5 percent of the global population, it now has only 21.5 percent of the global Gross National Product. The United States global market share has been halved. The United States can no longer be the economic bully of the world — slowly and often painfully it is learning to be a team player.

Does this mean that the Canadian Plains must become the newest Silicon Valley? Is this the only viable strategy for future economic vitality? It does not have to be an either/or choice. It is a bit unrealistic to think that every locale will have to copy the model of the Silicon Valley. But it is realistic to conclude that every locale will have to creatively integrate technology into its own unique business opportunities. Those regions with large agricultural sectors, like the Canadian Plains, are strategically situated to lead in agricultural applications to genetic engineering. This research will be significantly enhanced by the future generations of intelligent computers. Many believe genetic engineering will be the next locomotive technology. The initial step, then, should integrate technology with one's present concerns.

Technology, like extractive goods, is a global product. The Canadian Plains with their global market experience are well positioned to capitalize on this new economic focus. With the leadership demonstrated by the universities of this region, you have the resources to develop the centres of training both in technical development and in practical implementation. Ideas and their creative use, grounded in one's own regional advantages, oriented toward global markets, are the broad economic factors in which future opportunities lie. But to take advantage of the changing economic climate, one has to prepare the soil for economic growth.

The Soil Conservation

Every farmer knows the importance of the soil. Anything will grow in good soil. Certainly after the dust storms of the 1930s, it has not been a matter to be taken lightly in the prairies. The soil of the Canadian Plains is their infrastructure. Will it be enough to simply improve the infrastructure of the past? I think not. Let me suggest two additional areas of improvement.

The first challenge is in creating an infrastructure attractive to employers in this emerging economy. This will take two steps. First, one will have to provide an infrastructure which promotes the exchange of information. For most of history, economic activity and growth centred around seaports and railroads. But in an information economy, where at the turn of the century 86 percent of the work force will be providing services related to information, new centres of business activity will need to be created. One response has been the creation of the teleport. A teleport is a sophisticated communications centre through which users can transmit and receive voice, data facsimile, video and other types of communications services — via satellite as well as land networks. The Texas teleport based in San Antonio is a model of this information-age infrastructure. Telecommunicatons will be the highway and rail of the future.

In addition to making information more accessible to businesses, local governments will also have to consider promoting global partnerships. The 1979 international tariff-cutting agreements, which cut duties on many manufacturing products, will create more competitive pressure for Canadian industries. Yet there is a continued pattern of underinvestment by Canadian businesses. Action is needed to make local and foreign investments more attractive. Oregon's efforts at courting Japanese business have recently proved to be very profitable as both NEC and Fujitsu are establishing plants in the Portland area. In both cases, the Japanese firms cited Oregon's rejection of the unitary tax law as the key factor in their decision to locate there. Removing structural barriers to global partnerships will be necessary.

The second opportunity is in creating an infrastructure attractive to the employee. The old industrial economy was based on a product infrastructure — transportation, natural resources, and proximity to markets. Today's information economy is oriented to quality of life — climate, education, crime rate, and cultural and recreational opportunities. Every location will not have all these advantages. The task is to enhance those that are distinctively your advantages. Boston has a very high cost of living and very bitter winters, but many people are moving there from the Silicon Valley because of the many educational and cultural opportunities the city offers. They say in Seattle, you know it is spring when the rain gets warm — but obviously there are other advantages which make it an attractive area in which to live. The Canadian Plains have many such advantages. Known for their rolling plains, the rugged beauty captured in Terrence Malick's "Days of Heaven," they have abundant lakes and wilderness areas. Many authors note that the prairies "remain one of the most desirable of the underpopulated areas of the globe," or "one of the world's last frontiers for the hunter and angler."

What is the economic soil pH of the Canadian Plains today? The opportunity appears to be great. The region is not weighed down with a large industrial infrastructure. It has been more open to the concept of free trade. It has a long experience with a global orientation. There is a strong commitment to traditional values. There remains great love for the land — in maintaining its beauty and cultivating its richness. There is respect for the importance of the quality of life. The next question then is what seeds will grow?

The Growth Seeds

There are basically two kinds of seeds a farmer plants — hybrids or self-pollinating seeds. The economic analogy is a choice between foreign or local businesses to create economic growth. Many regions in the United States concentrate on imported hybrid companies, usually from Japan or Germany. Imported hybrid companies, like the seeds, are often expensive and sterile. Local governments are sending delegations to the Silicon Valley or to Japan to court high-tech firms to their area. Everyone wants to have a Silicon Valley in his backyard. Over fifty cities were competing for the Microelectronics and Computer Technology Corporation (MCC). Austin, Texas, was the final choice, but at a cost that would have bankrupted most other states. I recommend you grow your own. Start with the Canadian Plains using indigenous self-pollinating companies which are cheaper and far more prolific.

The question then is what size crop to plant? Large corporations or small businesses? The facts are in. Over the past ten years

Fortune 500 companies have contributed to no net increase of jobs. During this same ten years small businesses contributed to 66 percent of all new jobs in the United States. The focus should be on entrepreneurial seed, characterized by creativity and courage. Here is where real growth opportunity lies.

In the past being a Canadian meant to live off the fat of the land. In the future Canadians will have to live off the quality of their thinking. The Kansas experience may hold some interest. Municipal leaders in the state identified that much of their problem requires a major change in attitude. They are not risk-takers, but have learned a conservative style of business from farming. They started a Center for Entrepreneurialism at Wichita State University. It has received national attention and is being copied in other areas. The Advanced Technology Training Center is an important start. Ultimately it is the dynamism within people that causes economic growth. The needed changes are not all structural or technological, many stem from attitudes. What is needed consequently is not new methods, but new role models — individuals who lead by their example.

The Responsible Farmer

People are tired of top-down political decisions over which they have no control. In politics and in business we are moving toward participatory democracy. People want to be a part of the decision-making process when issues directly affect their lives. At least a partial explanation of the defeat of the Rhode Island Greenhouse Compact, a broad industrial policy, was that it was imposed from above. Similar resentment has been expressed in recent months in Manitoba over bilingualism. There is a demand for more grassroots initiative. In the United States it has been local governments which have been the most responsive to the challenges of education, for example — often preceding the national commissions with needed solutions.

Models of leadership are also changing. During the 1960s Ralph Nader was the widely recognized leader of the consumer protection movement. Who is the leader of the nuclear freeze movement? There is not any one leader. In the United States there are over 480 local organizations addressing the problem.

This conference is a gathering of leaders. The issues of this conference have no easy answers, they demand intelligent choices. How will you involve the people? How will they be given some sense of ownership over the needed future directions of this region?

It is useful to contrast two types of leadership illustrated by two cities: Baltimore, Maryland, and Greenville, South Carolina. Both cities have two things in common. First, they are both feeling the stress of movement away from older industries. Second, both

cities are responding positively to different leadership strategies. Baltimore is characterized by a strong city hall. Mayor Schaefer models himself after former Mayor Daley of Chicago. He has a top-down approach to leadership. It should be noted that the city has prospered under his lead. In contrast, Greenville has a grassroots leadership development programme. Started ten years ago, it is a programme which takes forty-five potential civic leaders from government, business and education and puts them in an intensive yearlong training programme. As a result Greenville now has a grassroots group of five hundred people trained, networked, committed and available for community action. This is a model to consider. The problems of a strong city hall can be seen by looking to Chicago today. Without the one strong leader the city has fragmented seriously. Leadership initiatives must include grassroots participation.

Conclusion

Farmers have always been known for their hard work. In these times of change there are many voices clamouring for attention. There are those who fear that technology threatens their job security. There are those who are concerned over the potential polarization technology may bring. There are those who fear because of change itself. These are times when the true leaders stand out. People are looking for visionary leaders to reach to the future and have the ability to motivate people to focus on the future. Future harvests depend on present action — the ability to prepare the soil of a people-oriented infrastructure, the ability to plant the seeds of entrepreneurialism and the ability to tend the crop by providing leadership which builds bridges across interest and regional factions toward a renewed sense of partnership and teamwork. Present decisions matter. For, as Peter Drucker reminds us, "Long-range planning does not deal with future decisions, but with the future of present decisions."

III

THE IMPLICATIONS OF NEW TECHNOLOGIES FOR EDUCATION

Milton McClaren

Introduction

It is quite apparent that these are difficult times for the institutions of public education. In many parts of North America and western Europe the public schools, colleges, and universities have been, and continue to be, attacked for their "failures." The public schools are seen as responsible for the decline in supply of technically trained workers so that Canada can remain competitive in the new "High Technology" fields. They are simultaneously accused of not providing the sort of science education which can equip people to function in a scientifically informed and literate manner in an era of science and technology. Technologists accuse schools of providing a science education which is too divorced from the "applications" of science as embodied in many new industries, while scientists charge the schools with "turning off" potentially talented students, especially women. In addition, the claim is often made that the schools do little to help students think about the consequences, or ethical and social implications of new technology. There are many critics making many claims, and urging many different programmes for school "reform."

It has frequently been noted that we may be living in a period of "paradigm" shift, a change in the major structures of our society, in our assumptions about the nature of reality, and in our ideas about human nature. This shift has been termed "Post-Industrialism" or "Third Wave."[1] The evidence of economics and politics certainly conveys the impression of confusing, and even frightening times, not just for the young, but for everyone. In the developed world stable economies are encountering increasing difficulty in maintaining employment, especially among the young, and in meeting the demand for a variety of social services. The number of old people is becoming proportionately larger than ever before, and with that change in demographics, our culture will also likely change as well. The application of computer and information technologies is transforming the world of work, creating new opportunities, but at the same time eliminating many types of work formerly done by humans, or down-skilling the requirements of other occupations.[2] If machines can do the work of humans, even moderately skilled humans, then the value of workers is questioned. While the United States appears to have emerged from the recession of the late 1970s and early 1980s, it

remains to be seen whether or not that "recovery" has not been fueled largely by massive government spending, mainly in armaments, thereby creating a massive deficit, and the tremendous strains on the monetary system of the world. Small wonder that people faced with great stresses begin to question the institutions which support contemporary society. The public schools are one such institution.

It is one of the ironies of democracy that those who are expected to design and implement the schools of the future have only ever known the schools of the past.[3] Thus, faced with demands from concerned parents or from the business community, they often seek school reform in a "return" to highly idealized notions of the schools of the past. To create the educational institutions of the future (and they may or may not be schools) we need to understand something about the schools of today, the mass, public, industrial era schools.

State supported public education, mandated as accessible to every child, is a phenomenon of the Industrial Revolution.[4] In the United States and Canada the public schools have made basic education available to virtually everyone. Prior to that time the rich, the lucky, or the very persistent managed to obtain an education. Even after the advent of public schooling, in many European states, and to some extent in North America, the wealthy continued to "purchase" elite educational services at high cost "private" schools and academies. But public schools have been a great leavening agent in industrial society. Previously, social mobility was severely restricted. For generation after generation people remained (and were expected to remain) in the social "station" to which they were born. The educated were the "managers" and governors of society, and, in some cases, they were simply "examples" reinforcing the notion of inequality and yet providing objects of "respect" or worship for the less fortunate classes. In pre-industrial society the ruling classes governed, planned, and practised politics. They created and exemplified the "values" of the culture. Their role was symbolic and practical. The working classes worked, in concert with animals and a few simple machines. Sometimes, the small professional armies were expanded by the addition of hundreds of worker-soldiers, who once again required a few simple skills, hand tools, and the willingness to obey without question.

In pre-industrial society the ruling classes were often quite well educated. Their education was intended to support and reinforce their roles and their status. It prepared them to govern, to make decisions, to negotiate and manipulate at a high level, and to plan. Rulers also needed to be able to communicate — to speak well, to read, and to write. The liberal education was a "practical" education if it is seen as being comprised of the skills required to

rule, for the reinforcement of cultural values, and for large scale policy planning. It was a "meta-education." Machiavelli's classic *The Prince* is a wonderful example of a "textbook" for this sort of education.

However, in a pre-industrial society the workers needed little in the way of a meta-education. The family unit provided the majority of education and taught children the few simple skills they would need. Few could read and write, or needed to. The church usually provided some additional information and training, but always within the context of dominant religious beliefs and values. Few members of the working class escaped, although sometimes bright youngsters would be selected for a limited further education, for technical training in a skilled trade, or for indoctrination to the priesthood. The education of this group focussed on the acquisition of a few skills, or a specialized trade or craft and on the acceptance of one's station. Their education was a "micro-education" or an indoctrination more often than not.

The rise of industrialism changed this. It created a need for workers, in large numbers, who possessed skills which the family could not provide, to equip them for work that had never been done before.[5] The mechanization of war created more sophisticated weapons and required more advanced training for soldiers. It changed the pace of life, and by beginning the application of machinery to the generation of information via the mechanized printing press, it also created the need for a managerial group, a type of person who could provide assistance to the "owners" or "bosses" in dealing with the mass of information and with the pace of its generation. These "middle managers" were the human computers of the industrial age. They became expert in the storage and recall, plus analysis of information from a particular field or area, such as commodity prices, exchange rates, or the disposition of ships. The new ruling or governing classes (which sometimes contained the same families as before) needed these human computers to provide them with up-to-date, reliable information on demand, and with a certain amount of analysis and advice. The rise of many great corporations can be linked not as much to the knowledge of the owners who provided the capital as to the presence of highly competent middle and senior managers. A chain of human beings collected, organized, analyzed and transmitted information. *Human* brains were the information processing units of time, and, to a great extent they were also the "memory banks" at least for key information. But, of course, a great number of people worked not with information but with "stuff:" with machines, with ore, with fibre, with animals, with metals, and so on.

In industrial society there are broadly three sorts or levels of education. Those who are the bosses, the "Captains of Industry,"

the senior politicians, and the generals need an education generally similar to that of the rulers and princes of the past — in fact, they are often referred to as the Coal or Copper or Railway "Barons." They not only direct policies and formulate long range plans, they exemplify the higher order values. They are the patrons of the arts and religion. They are the great philanthropists. Through scholarships and endowments they even support the further education of able young people from the "lower" classes. Their education is somewhat different from that of the rulers of the past, but not as much as might be imagined. For many people in industrial society, however, education and schooling, public schooling, are synonymous and this consists largely of teaching the student to read, to write, to do simple computations, to recall basic facts, and to follow routine instructions in a disciplined way. The school socializes the workplace, and the workplace in industrial society emphasizes routine, pace, and the repetition of tasks. The educational preparation of managers is an extension of the skills of the worker in the direction of "people" management and in the direction of analysis, assembly, and evaluation of information. Some middle management entails decision making, but usually within fairly defined limits. Many middle managers are constantly preparing reports, memos, and advisories which are filtered up to the corporate heads, the senior managers, or the politicians, who use the information, evaluate the advice, and make the decisions. The managerial group in industrial society are not so much decision makers as they are elements in a system of communication and information based on people rather than machines. They are also elements of control and regulation over the workers lower in the system.

Given this perception of industrial society it is not hard to see why schools emphasize the things they do, especially public schools. Basic communication and computation skills are needed. The worker needs them, but at a fairly simple level. The manager needs them to a greater extent. The manager also needs to remember and recall quickly a lot of factual information, and, failing that, to be able to remember where to find it in paper-based record systems. Because of the sheer volume of information being generated however, industrial managers often quickly become specialists in one field. The senior managers and the policy makers must retain the ability to get an overview, to put together the information from the specialists, and to make meaning of it. To serve such a distribution of requirements from the workplace, industrial schools are quite justified in their emphasis on the so-called "basics" and on recall of factual information, with a curricular structure favouring specialization and compartmentalization.

To be fair to schools, many teachers have understood that

education is often different from schooling and that "fitting" children to meet the requirements of the workplace is only one part of the educative function. In fact, it might be argued that it is never the role of an educational institution to stream students to a single type of employment, or even to a certain level of work. But schools are "public" institutions, which means that they are tax supported. It is easy to criticize schools for educating people who may, as a consequence of being educated, actually opt out of work in the categories seen as "needed" by society at a given point. If, moreover, a larger and larger portion of the schools' funds are raised by taxes paid by large corporations, then how likely are these bodies to support a system of education which equips people to criticize those corporations, or to accept values other than those of a corporate society? It is one thing to patronize a few philosophers, artists, and critics, but is quite another to potentiate their regular development in sizeable numbers of people. Training may be a value, but is education?

As we enter the post-industrial era, we are at a stage of making critical choices which have not so much to do with technology as with values. The widespread use and development of cybernetic systems and of robotics can portend a fundamental change in the training requirements of the modern worker. Up to this point most governments have argued that these new technologies will create more new jobs than they will eliminate, but that they will raise the level of technical training required. This analysis may be a soporific or palliative, but it is highly unlikely to be accurate. I can scarcely find a single form of industrial work, white or blue-collar, which cannot be either eliminated or significantly reduced in manpower requirements by the new technologies. Industrial society was characterized by a large number of jobs which paid a reasonable wage for work which demanded basic skills. In the pre-industrial period agriculture and food production were the dominant forms of work. They were also the first to be highly mechanized with consequent major reductions in the number of workers required. Less than 3 percent of the American work force now works in the agricultural sector. Were it not for an abundant supply of cheap, often immigrant (and even illegal immigrant) labour, many other sectors in agriculture would have been mechanized and automated. Needless to say, the remaining workers are often unskilled and even illiterate. Of course, the workers displaced from the farm went to the factory, and, over time, many, especially women workers, went to offices and to the service sector. But, in the past decade hundreds of these jobs which require basic education in computation and communication have been eliminated. Union contracts have delayed the process, but the unions are being weakened by the economics of our time, and by the down-skilling and down-salarying of many

workers. Where new jobs are to be found they are often in unorganized sectors. Moreover, workers who are desperate for work, any work, are unlikely to organize, and will accept substandard conditions and low wages.

Modern industry seems to be using an approach to the work force which might be known as the "stick and stick" (as opposed to the "stick and carrot") approach. The first stick is the threat to automate (usually supported by partial automation). The second stick is the threat that if they are not going to automate, they cannot be competitive, unless the workers will accept low wages, guarantee not to unionize, and will "give back" previous benefit packages. Some companies even fire long term employees only to re-hire them in a short time at drastically reduced levels of wage and benefit. Of course, automation in key, well paid, skilled, organized sectors of the work force has the effect of driving labour values down without other corporations ever having to actually automate themselves. In effect, therefore, one result of the development of robotics and automation may be the evisceration of the work force, forcing workers to surrender benefits, and displacing workers to new categories generally requiring less skill. In this scenario attacks on schools will emphasize training deficiencies, and, most important, will challenge the value of education per se. "After all, what good is a Ph.D. in Sociology if you're unemployed?"

In a strange way, then, high technologies potentiate a "lower" life, and actually recreate the pre-industrial system, with few, elite, well educated bosses and a large mass of workers who engage in quite unskilled work. However, there will be a mid-group, replacing the mid-managers of the industrial era: they will be the technicians who will design the systems and do the research and development work. Their education will be as it is now: intensive, but highly specialized, a training, rather than an education. It is difficult to predict how many people will be needed in this category, but I suspect it will be about 10 percent. Schooling will emphasize utilitarian values, with, of course, a handful of wealthy or fortunate people being able to gain access to higher education (and possibly even to secondary education) in the humanities or arts.

The things which I have said above may sound like the pages from some sort of Orwellian futuristic fiction novel. However, every single one of the processes which I have described above is now either underway or in active policy discussion among corporations and government in the province of British Columbia. There is, I am happy to say, an alternative scenario.

It has long been a dream of humans to live in peace in a world where there was opportunity for recreation, art, music, culture and civility. It would be a world without poverty and overpopulation, with equity, and with freedom from disease. This vision is an

ideal, and it is also a value-scape, because it reflects how our priorities might be rearranged. We now have the technical capacity to create many elements of this vision. We do not have the value system to permit it. We have developed a tremendous technological capacity but we have not developed or fostered equivalent power in making value choices about how to deploy our technologies. Thus, a tremendous proportion of the scientifically and technically trained manpower is engaged in work related to war, to the global arms race. Many elements of high technology, not only in physics, electronics, metallurgy, automation and communication, but in biology and chemistry as well, are devoted to the pursuits of defence. In many of the underdeveloped nations people die of starvation, or from polluted waters while scarce resources are invested in twenty-first century weapons systems. It is hard for us to comprehend the possible work that could be created were we to reallocate our priorities and begin to address the problem of war and violence.

There are two central educational challenges in this scenario: one occurs now, and the other will occur in the future pending the outcome of the first. The first challenge is presented in the engagement of the full resources of human intelligence on this planet now, among peoples of all ages and cultures, toward the solution of the problems of war, violence, and militarism. What kind of schooling is required to create the potential for a peaceful world? It would seem to me that it may be quite different from what is taught now in the explicit, implicit, and null curricula.

If we actually begin to move away from the risk of global nuclear war and start to reduce our tremendous diversion of manpower, resources, and technology from warfare, then we will enter the context of the second challenge, namely how to deploy our technology to pro-human, ecologically sound purposes on the planet. Again, questions of value will be central in this as well. We cannot hope to attain a lasting peace, even if we disarm the nuclear powers, while the grave inequities exist in the distribution of wealth and opportunity on earth. What kind of schooling is needed to create the potential for healthy, happy humanity on a global basis? What sort of curriculum has those elements of training and education? What sort of skills are required? Whatever the specific answers to these questions, I am quite sure that education in the context of this scenario is concerned with enabling and empowering human creativity, imagination, disciplines, empathy, and inquiry to the highest possible levels.

I think it is possible to see that in one direction it is quite likely that the focus of schooling will be on "training" and particularly on training for specific jobs in the work force. Industry will see itself as acting in its own interest to demand that its tax dollars are spent to support schooling which has use to it, now, and in the immediate future. People concerned with jobs, both their own, and those of their children, are quite likely to support these

notions. But if schools are to educate they must address more than the vision of vocational preparation. Even in this sector of their activities they need to seek expansion of the range of vocational choices, and an understanding of vocation per se, as opposed to fitting square pegs into square holes. But recent studies of schooling in the United States have shown that parents, students, and teachers alike expect public schools to achieve four missions. One of these is vocational preparation. The others are the intellectual development, the personal development, and the interpersonal-social development of the student. Furthermore, it is evident from this research that parents will criticize the schools if any of these missions are left undone, or are done poorly.[6] In short, people expect schools to educate, not just to train. But the pressures are growing on schools. More than 40 percent of the Canadian population now has no direct involvement with public schools: they either do not have children of school age, or their children have graduated. Will these people continue to wish to support schools, especially as the demands of an aging population grow for other services? Other surveys have shown that young Canadians rank "fear of nuclear war" first among their concerns, but worries about future employment are second in priority.

The post-industrial era places us in a time of critical choices. Changes in the types and nature of work, and in its availability, coupled with changes in the age structure of society can lead to a narrowing of the role of public schools and other educational institutions, combined with reduced resources to conduct any mission. At the same time, the development of new technologies in every field faces people of all ages with the need to consider and decide on difficult questions of value and priority. It is hardly the time to diminish the availability and scope of quality education.

To close, I wish to make several suggestions about the curriculum of schools in a post-industrial world.

1. There must be a careful balance among the four central missions of public schools. Thus, the personal, intellectual, social, and vocational development of students all need to be dealt with systematically and explicitly in the modern school. It should not be assumed (as has often been the case) that one area will be a coincidental outcome of one of the others. Thus, intellectual development with a high quality academic programme does not necessarily guarantee a student with the skills and attitudes needed for good citizenship.
2. The schools need to operate in a state of creative tension with other educative forces in society: business, media, and even the family. Schools address the common needs

of humanity in education — the other agents often address their special needs and perspectives. The schools must especially recognize the power of the mass media and their capacity to inform (and sometimes even to educate), and must not act as mediators and thoughtful critics of the media. The public schools are not the servants of any particular interest group, but rather they are the trustees of the process of education itself. To the degree that they are co-opted to the demands of any special interest group, or are limited in their accessibility or in the equity of their operation, their capacity as educational vehicles is reduced.

3. In the light of new technologies to transfer and store information, schools need to question what humans do best in the teaching-learning process. This entails a move away from the emphasis on information transfer to students and on recall by students toward teaching students how to access, evaluate, critique, and synthesize information. There also needs to be a greater emphasis on conceptualization. Facts change, often at an alarming rate, but concepts, processes and principles are more enduring.

4. It is critical that students be taught how to evaluate and assess the consequences of developing and implementing new technologies. They need to be educated so they can behave other than on the basis that if something can be done, it must (or should) be done.

5. We need to develop a modern core curriculum appropriate to our times, but reflective of human culture and history. This core must include communication skills, an understanding of number-value-quality relationships, the arts, science (as a process and as an element of culture), and social studies. Teaching should enable students to have access to, and to use modern communication and information technologies fully. The core should also contain a physical education-recreation-life style component. The core should likely occupy 90 percent of time, but the remaining 10 percent, from Kindergarten to Grade Twelve, should be available to student choice. Students should be able to exercise that choice in various ways, including contracting, work experience, peer tutoring (giving or getting), community service, and so on. The structure and operation of the curriculum should emphasize success, performance, development, and mastery. Grades and summative evaluation should be de-emphasized.

6. The structure and operation of schools should emphasize co-operation as much as competition and the relative merits of both should be examined in any task.[7]
7. The structure and operation of schools should take advantage of the information technologies to make instruction accessible, personal, and individualized where appropriate. The schools should also appeal to and employ methods which recognize and empower a range of human learning styles.
8. The style and operation of schools should emphasize learning as a lifelong process. Perhaps one way of doing this would be to open public schools to residents of their communities of any age, to take any subject or grade, free.
9. The public schools need to see themselves not so much as sources of all the resources for learning but as clearinghouses to help all members of the community engage in their own learning and contribute to the learning of others. This would include corporations, industries, churches, clubs, libraries, recreation centres, families and individuals. However, the clearinghouse approach must be balanced against the tendency of those who contribute to declare ownership and control.
10. Obviously, if we are to have schools appropriate to the present, let alone the future, we must have teachers who can operate such schools. Teacher education must be reconceptualized and an entirely new curriculum must be developed which allows educated people, who care about education, to become effective in accomplishing the full range of educational missions in the context of the modern world.

Finally, I should address a few remarks to people who are anxious about computer literacy. There is no doubt that the ability to use (and, even more critical, to have access to) computers will produce a new class of "haves" and "have nots" in the near future. Computer literacy does not consist in learning to turn the machines on and off, or in learning to programme in BASIC. I have read Papert's *Mindstorms* but, having seen people use LOGO, I am no more convinced that either computer literacy or higher level skills in thinking and problem solving arise from it than from learning geometry via a traditional text. Computer literacy as an end in itself is a sterile activity for most people.[8] However, learning to use computers in the intercourse of human affairs, and learning to ask when and when not to use their power — these are the critical questions. I agree with Turkle[9]

when she sees computers as "evocative," as mirrors of ourselves. Some people, a handful, will benefit from knowing about the "innards" of computers, but, far greater opportunities will exist for those who have the imagination to recognize computers as metatools, as tools which make possible many things which we decided were not possible, that were in the "what if . . ." or ". . . if only we could . . ." category of human invention. I want people to learn to use computers as naturally as breathing, but I want them to focus not on the mechanics of their use but on the ethics, possibilities, and power of their application to human life.

NOTES

1 Fritjof Capra, *The Turning Point: Science, Society and the Rising Culture* (New York: Simon & Schuster, 1982); John Naisbitt, *Megatrends* (New York: Warner, 1982); Theodore Roszak, *Person/Planet* (New York: Anchor Press, 1977); Alvin Toffler, *Previews and Premises* (New York: Morrow, 1983); *The Third Wave* (New York: Morrow, 1980).

2 Eli Ginsberg, "The Mechanization of Work," *Scientific American* 247, no. 3 (1982): 66-76.

3 John Goodlad, *A Place Called School* (New York: McGraw-Hill, 1984).

4 Roszak, *Person/Planet*; Toffler, *The Third Wave.*

5 Goodlad, *School.*

6 Ibid.

7 Robert Axelrod, *The Evolution of Co-operation* (New York: Basic Books, 1984).

8 Alan Kay, "Computer Software," *Scientific American* 251, no. 3 (1984): 52-60.

9 Sherry Turkle, *The Second Self* (New York: Simon & Schuster, 1984).

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IV TECHNOLOGY, EMPLOYMENT AND OCCUPATIONAL CHANGE IN THE PRAIRIES: WHAT LIES AHEAD?

Graham F. Parsons

Introduction

In recent years we have all been blitzed with reports telling us that major changes are underway in our economy and society. The Science Council of Canada declares that the information society is already upon us.[1] Micro-chips will transform our lives. Advances in the computer revolution will bring about a new economic and social order. Genetic engineering will revolutionize agriculture and health care.

Some observers contend that collectively entrepreneurial decisions have shifted the output and employment mix away from the production of goods and toward services over the past decade, far surpassing the rate of change of previous decades. Hence, Hawken notes that the economy "has become so surprising, confusing and unsettling that it is now the central concern in the lives of people and their government."[2]

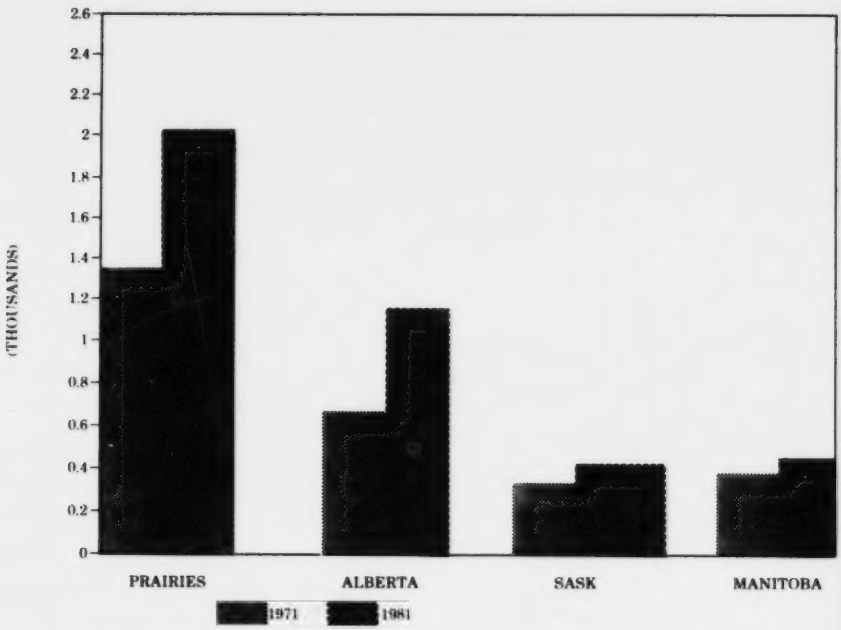
The Human Resource Advisory Group of the Canadian Plains Research Center has been rightly concerned over the implications of these changes for the prairies. At a workshop in January 1984 technology in the labour market was identified as a major concern with diverse related issues for the prairies.[3] Has the information economy really reached the prairies? What does "de-industrialization" mean for resource regions that never industrialized? Is technology displacing jobs? Will new technology require more skills? What could these changes mean for the practices and policies of individuals, labour unions, companies and governments?

In particular, the Canadian Plains Research Center has its focus upon the Canadian Prairie — a land that does not fully reflect the social or economic characteristics of the regions that have been at the centre of the new technologies or the evolution of an information economy. The prairies, even in 1984, remained highly resource dependant in two of the three provinces. The small, highly dispersed prairie population is quite different from the industrial, often metropolitan, economies that have been the subject of frequent review.

Major changes are underway within prairie labour markets. For the prairies as a whole employment grew from 1.3 million in

1971 to 2.0 million by 1981. The over 50 percent growth rate for the prairies, however, was the result of very high growth in Alberta (79 percent) and much slower growth in Saskatchewan (27 percent) and Manitoba (27 percent) (Figure 1).

Figure 1 Prairie Employment



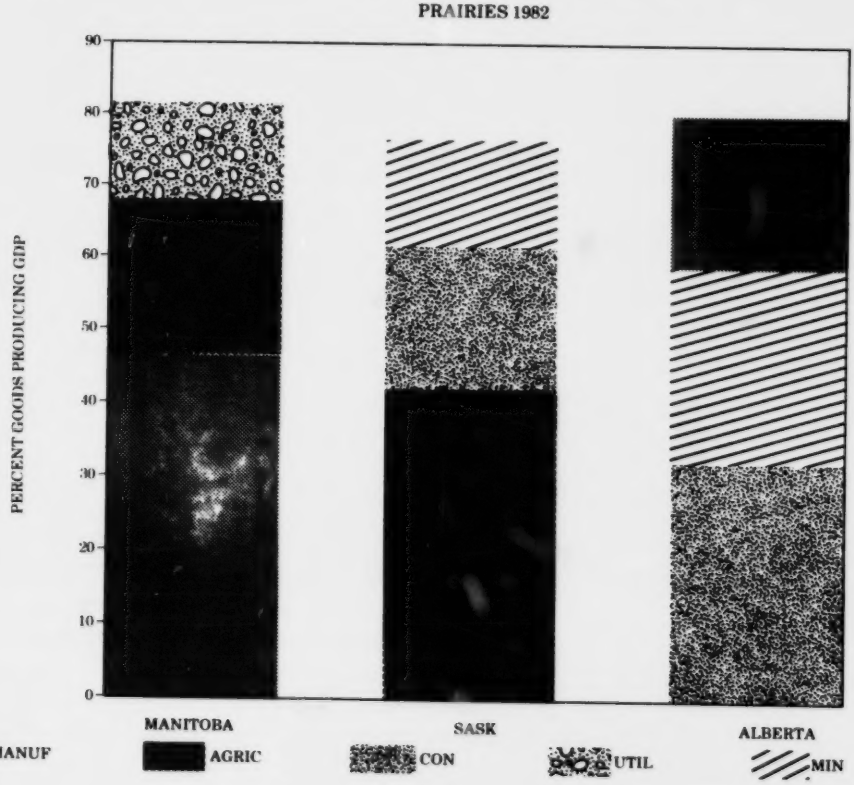
The observations that follow try to determine what the macro changes towards technology, services and information mean for the prairies. To examine the structural shifts occurring in the prairie economy and the related implications for this analysis, the Canadian Plains Research Center commissioned a review of the changing occupational and employment structure of the prairies between 1971 and 1981.[4]

Characteristics of the Prairie Economy

Provincial Economic Diversity

Each prairie province has a distinctive economic structure: with manufacturing dominating the Manitoba economy, agriculture still leading Saskatchewan goods production, and project construction still critical to Alberta's oil and gas mining economy (Figure 2).

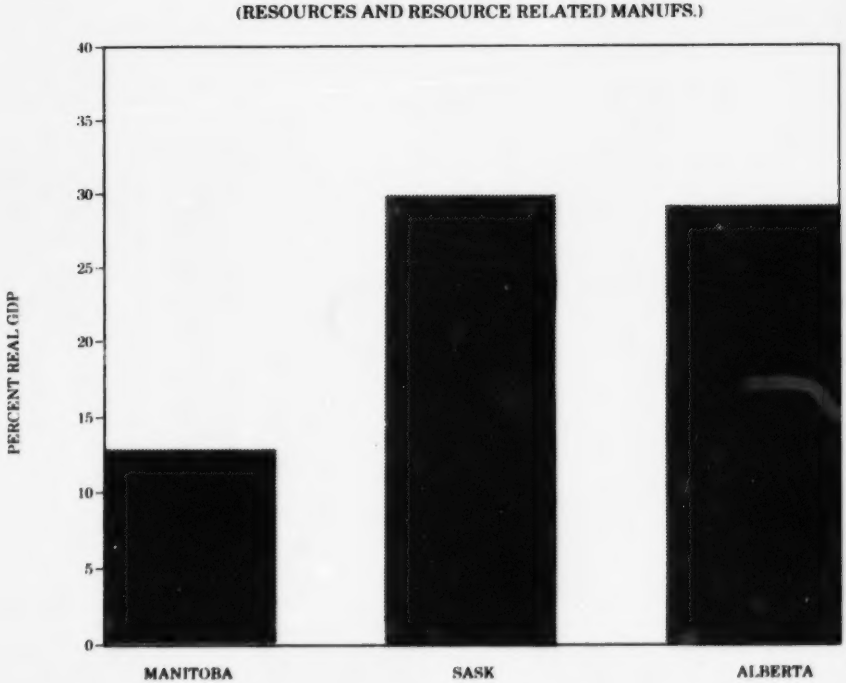
Figure 2 Leading Goods Producing Sectors



Natural Resource Dependance

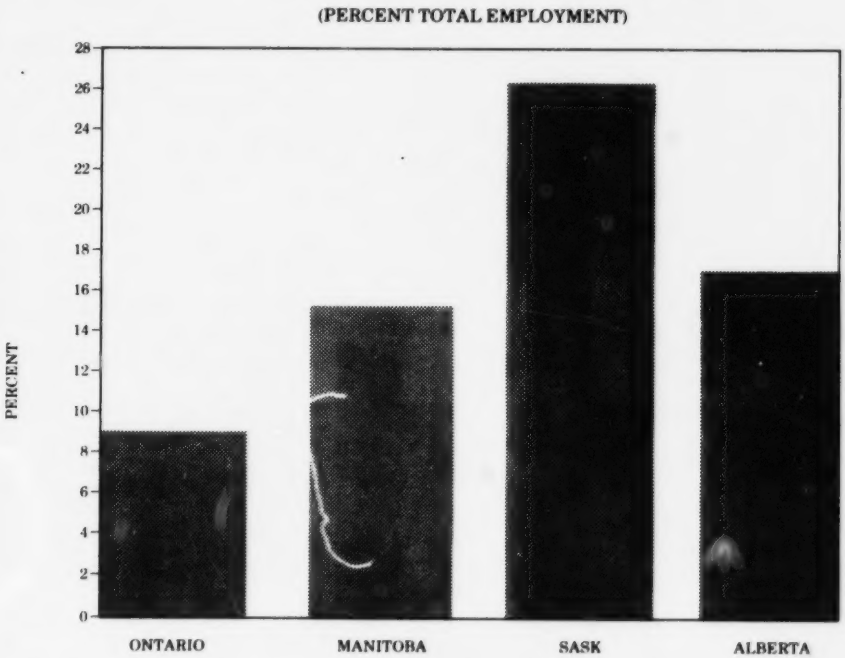
All three prairie provinces have significant levels of dependance upon natural resources (Figure 3) that place special requirements upon the occupational markets for development, operating, maintenance and service skills.

Figure 3 Prairie Natural Resource Dependance



Resource industry employment related to resource production has declined in relative terms but still remains significant in all three provinces, and at much higher levels than the more industrialized eastern province of Ontario (Figure 4). In addition, much service industry employment relates to the special needs of these resource sectors for information, trading, transportation, financing, development and management.

Figure 4 Direct Resource Industry Employment



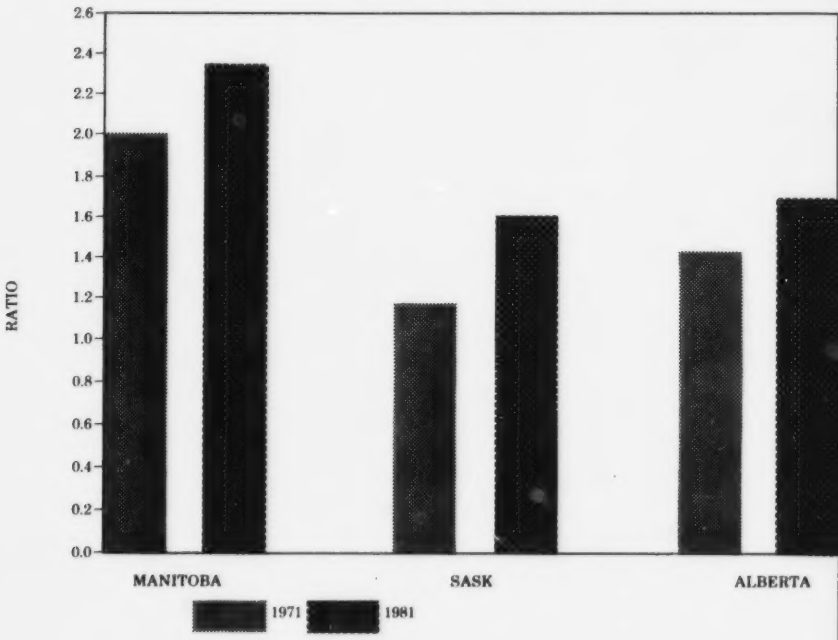
The Changing Structure of the Prairie Economy and Labour Markets

Service Industries Grow More Important as the Source of Jobs

Through the 1970s the economic structure of all three prairie provinces shifted in favour of the service sector, reflecting trends already well underway in other parts of North America. By 1981 white-collar workers outnumbered blue-collar workers, a distribution achieved in the United States as early as 1956. The ratio between service industry production and goods production rose in each prairie province. The shift was fastest in Saskatchewan, although the service to goods production ratio remained the highest in Manitoba, the most diversified prairie province (Figure 5).

Figure 5 Service to Goods Production Ratio

(GROSS DOMESTIC PRODUCT BASIS)



The increasing shift of economic activity towards services has been reflected in the structure of the labour market. Since the 1960s the share of jobs arising from goods production has fallen by ten percentage points from 43 percent to 33 percent (Table 1).

TABLE 1

Distribution of Output and Employment by Sector, Prairies

	Real Output		Employment	
	Goods Production	Service Industries	Goods Production	Service Industries
	%	%	%	%
1961	41	59	43	57
1971	40	60	35	65
1981	37	63	33	67

Over the past decade nearly three quarters of all prairie job creation occurred in the service sector (Figure 6). Service growth was led by the community, business and personal services sector, whose share of the labour market rose from 23 percent in 1971 to 27 percent by 1981.

Community, business and personal services accounted for over one-third of all new job creation over the decade, followed closely by trade occupations that accounted for a further 20 percent of job growth. However, while employment growth was concentrated heavily in the service occupations, it is worth noting that significant employment growth also continued to occur in mining, manufacturing and construction (Figure 7).

Figure 6 Share of Labour Force Growth

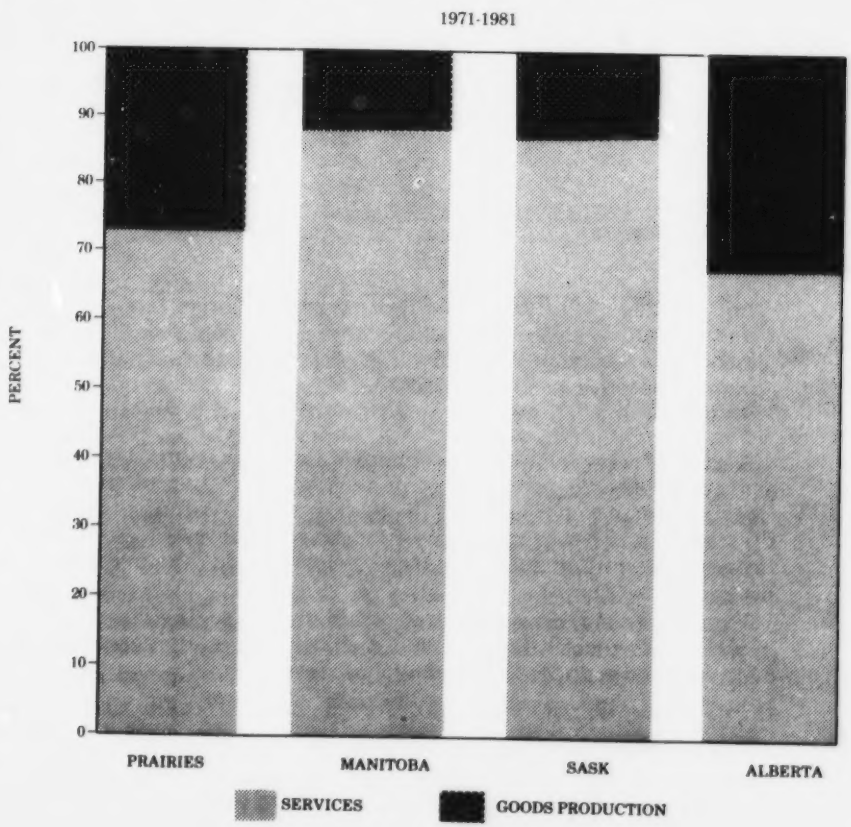
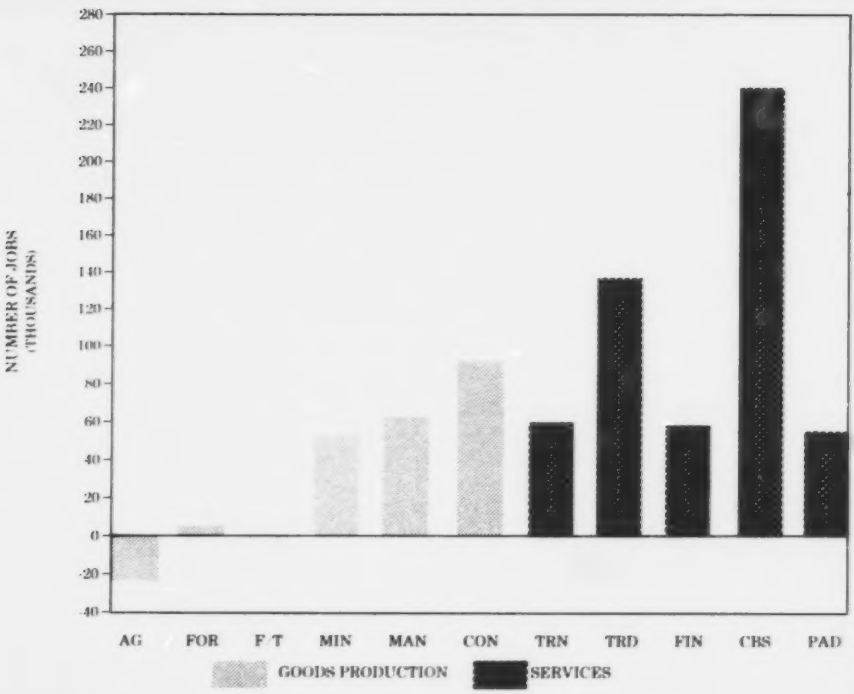


Figure 7 Employment Growth By Sector

1971-1981



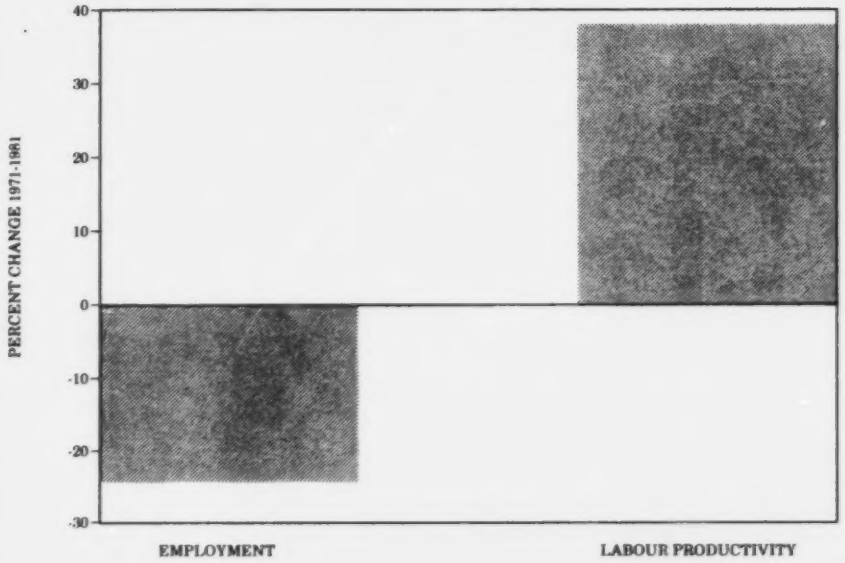
A major factor in the decline in goods producing employment arose from the 25 percent decline in agricultural employment. Continuing increases in the capital intensity of agriculture through the 1970s in the form of larger tractors, combines and farm size permitted substantial improvements in labour productivity (Figure 8).

This effectively continues a well established trend in the prairies in which advances in agricultural mechanization increased productivity and reduced farm labour requirements.

Occupational Growth Favours Information and Technology

The Science Council of Canada reported that from 1931 to 1971 the proportion of Canadian workers in information related occupations rose from 21 percent to 40 percent and that the transition continues at a rapid rate. Over the past decade in the prairies this

Figure 8 Prairie Agricultural Trends

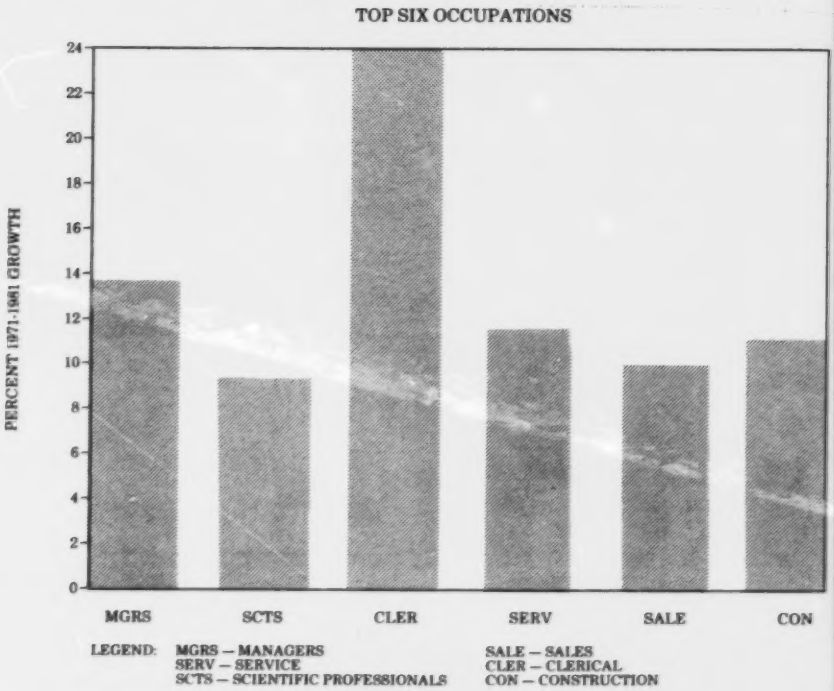


occupational trend has become well established. Occupations that can be considered information intensive, such as managers and scientists, and occupations that have experienced substantial technological change, such as electronic data processing and word processing, have also accounted for most of the occupational growth (Figure 9).

The top six contributors to prairie occupational growth between 1971 and 1981 were clerks, managers, service and sales workers, scientific professionals and construction workers. The first five of these, related to information services and directly affected by advances in electronic data processing and communications, accounted for two-thirds of all growth. Significantly, management and social science professionals also showed the largest increases in their share of the labour market (Figure 9).

These occupations, that include sociologists, economists and librarians, are all heavily involved in the analysis and application of information. Analysis of the major occupational groups for the prairies indicates that all of these "information" occupations were major contributors to employment growth, but that there were no marked trends of decline or slow growth.

Figure 9 Prairie Occupational Growth

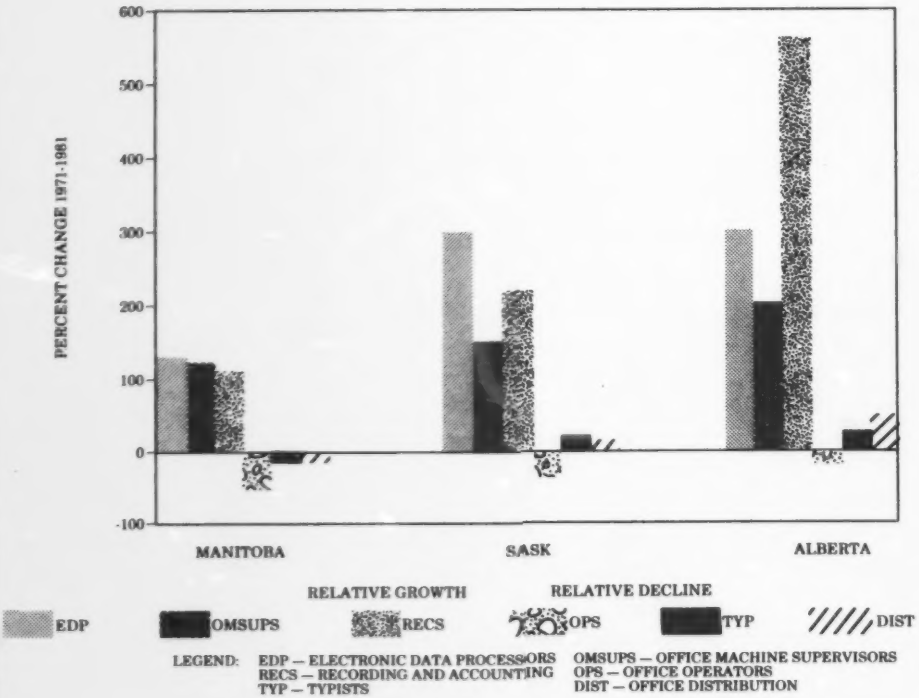


Within the management group of occupations major declines were experienced in jobs severely affected by automation or improved communications and information exchange. Thus, postmasters showed major declines affected by the drop in first class mail and the increasingly automated postal system. Similarly, purchasing officers and buyers declined by 40 percent, in part the result of improved purchaser/supplier communications systems.

The detailed effects of information and technological change upon the workplace are seen most clearly within major occupational groups and in the relationships between the rapidly rising and declining occupations. Within the large clerical group of occupations jobs related to electronic data processing, office machine supervision and bookkeeping and accounting, showed

rapid growth. Conversely, there were corresponding declines among office machine operators, typists and clerk typists, messengers, receptionists, mail and message distribution clerks. Seemingly, this confirms a major adjustment among clerical occupations resulting from advances in data processing and communications technology (Figure 10).

Figure 10 Prairie Clerical Occupations

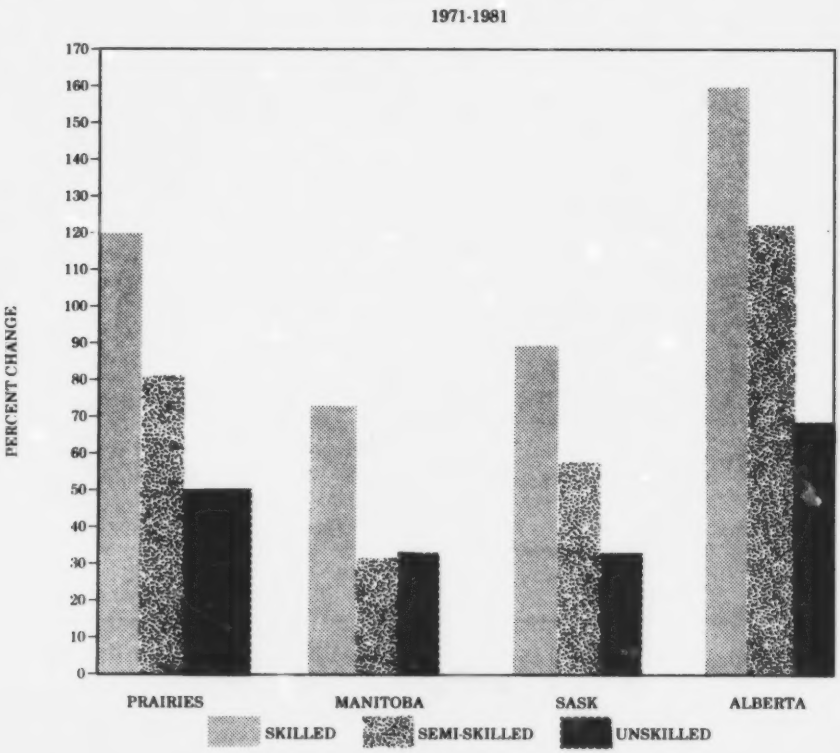


The Skill Requirements for Information and New Technologies Cut Both Ways

Analysis of prairie occupational trends over the past decade provides evidence of both increasing skill requirements and new low skill opportunities.[5] Within the large clerical sales and service occupations, employment grew fastest in the skilled categories,

although the 50 percent growth rate for unskilled clerks was still fast enough to increase the "unskilled clerks" share of occupations (Figure 11). Only in Manitoba did the growth of unskilled clerical occupations marginally exceed the growth of the semi-skilled.

Figure 11 Clerical Skill Growth



New technologies, however, also have the capacity to generate new lower skilled employment opportunities. This is also apparent within the health care field where there is evidence of proportionate declines in the highest skill levels of physicians, surgeons, and optometrists. It seems reasonable to presume that some of these declines are being met in the rapid increases that have occurred in para-professionals such as dental hygienists, dispensing opticians and medical technicians.

Future Prospects for the Economy and Labour Markets

One of the critical issues facing the full emergence of the information and electronic technologies is the degree to which it displaces existing employees through a radical transformation in the occupational structure of the economy. This implies detrimental effects for living standards. Some assessments of the future suggest new jobs will be created at the highly skilled top end and in the lowly skilled bottom end of the labour market.[6] A Standford University study concluded that only two of the ten occupations with the largest job potential through 1995 would require any postsecondary education.[7] What are the prospects for realizing these scenarios in the prairies? To some extent this question can be addressed by reviewing the economic and employment trends for the region.

Economic Structure Changes Only Slowly

Most evidence on the outlook for the prairie economy does not suggest a radical transformation of activity. Towards 1995 current trends suggest some increases in the share of goods production in the economy. Jobs, however, will remain concentrated in the service sectors of the economy and four in five employees will find jobs in this sector.

TABLE 2

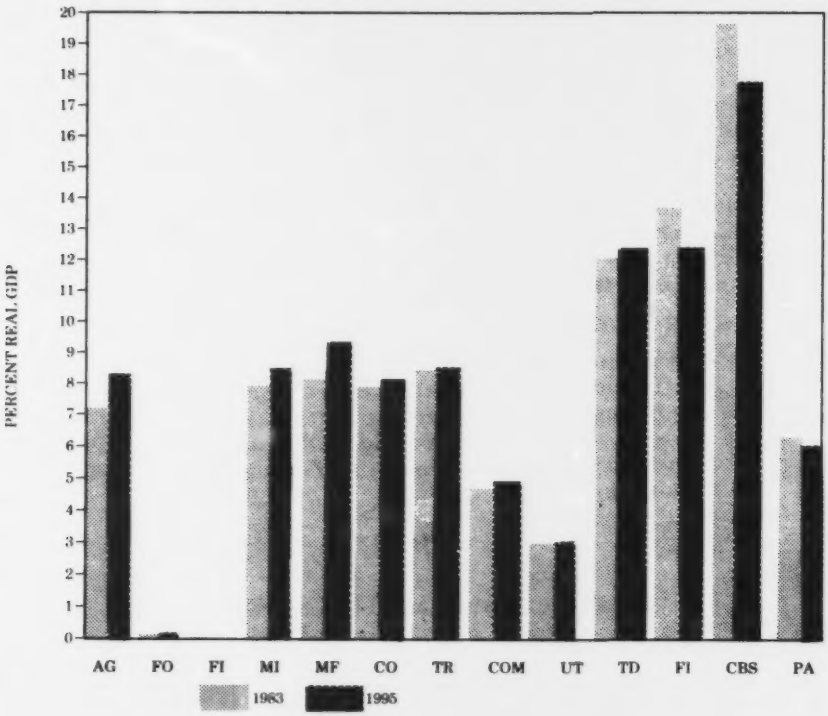
Prairie Employment and Output Structure

	Employment		Output (GDP)	
	1983	1995	1983	1995
	%	%	%	%
Goods Productions	28.8	27.4	31.3	33.9
Services	71.2	72.6	68.7	66.1
TOTAL	100	100	100	100

Most major industry divisions will continue their role in the economy with increasing shares for agriculture, mining and construction, and relative declines for most service activities (Figure 12).

Figure 12 Distribution of Output

PRAIRIES 1983 and 1995

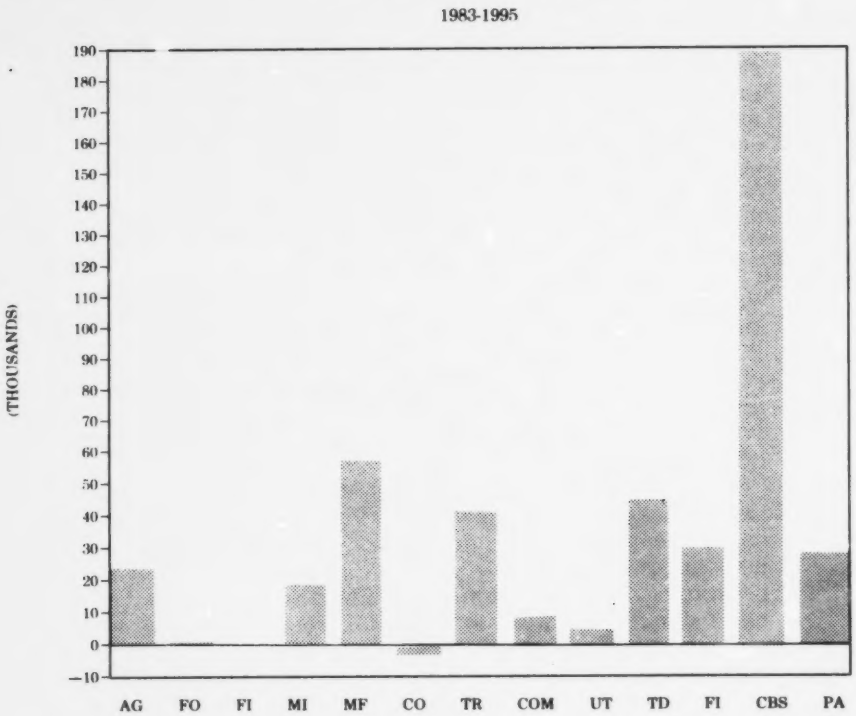


Occupational Structures Remain: Employment Continues the Shift to Service Occupations

Increasing productivity in goods production will lead to most of the employment growth occurring in the service industries. The major sources of job growth are again identified in community, business and personal services which account for two in five of all new jobs (Figure 13). This general pattern suggests that, although significant changes are underway in the economy and society, this will only change the labour market slowly.

The importance of various occupational groups will be much as it is today. Within this outlook it is probable that more low paying, low skilled jobs will be created than high paying, highly skilled ones. This, however, has always been the case. Those occupations that currently employ most people will almost certainly have the greatest absolute growth in the future.

Figure 13 Prairie Job Growth By Sector



Specific Occupations Can Expect to See Change in Prairies

As in the previous decade, specific occupations can still expect to see major changes in spite of the general stability that exists in the structure of the prairies. To some extent this may result from specific circumstances in the prairies, and to some extent, reflect a catch-up with trends that are further advanced elsewhere. For the most part new technology will be applied to the existing industrial and resource base.

Within the rapidly growing management group of occupations, further rapid declines can be expected for bank branch managers as automation proceeds through the banking industry. The Bank

of Montreal, for example, is reported as intending to cut its western staff by 7 percent, in many cases at the middle management level.[8]

Job losses in some areas, however, will clearly be offset by gains elsewhere, particularly in electronic information management and transmission and computers that underlie much of the new technology. The Science Council of Canada points out that electronic mail is already a reality, and that 70 percent of first class mail is now generated by computers.

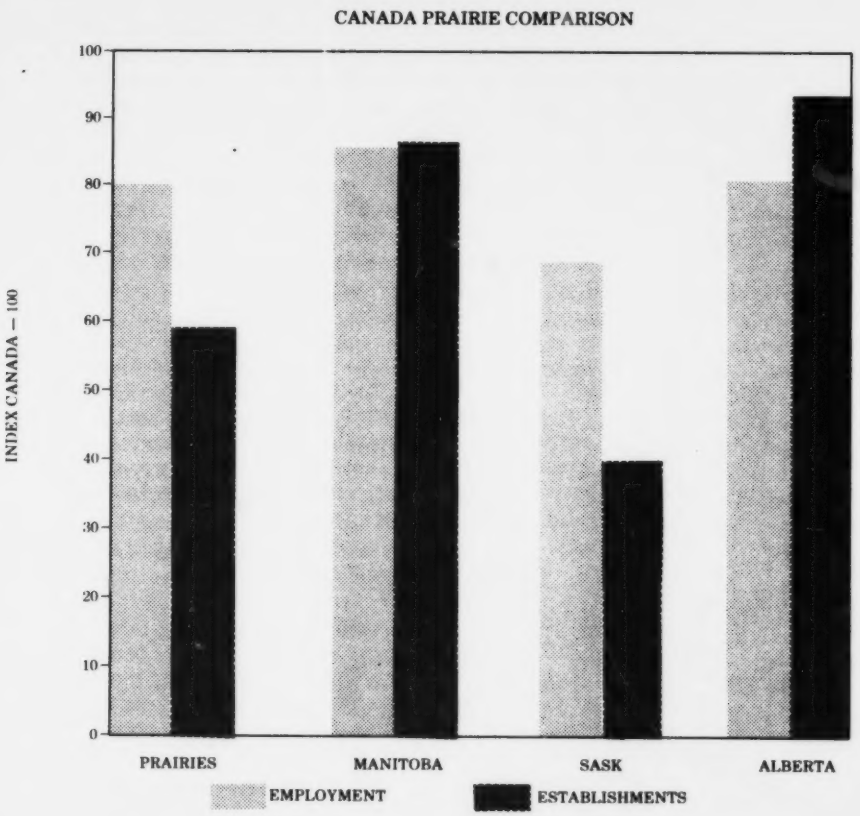
Review of the computer industry in Canada[9] suggests that it has seen less development in the prairies than elsewhere. On both an establishment and an employee basis the prairies trail Canada in the provision of computer services (Figure 14). Nationally, this sector has been growing rapidly, doubling revenues between 1979 and 1982. As computer applications gain more acceptance in the prairie agricultural and resource economies, substantial employment growth can be expected to continue in computer manufacture and retailing, software development and marketing and provision of Electronic Data Processing hardware and peripherals.

Many sectors of the prairie economy are only now considering the application of the new technologies to their often resource based occupations. One out of two office workers will have a personal computer by 1990. Maintaining high incomes in a competitive external environment requires the steady application of new technologies. Many agricultural processes are well suited to micro processor applications. It is to be expected that traditional agricultural equipment will be redesigned. Farm management and information can increase in the complexity of analysis and response to market conditions through increased computer applications. There are thousands of prairie farmers who are only now beginning to adopt the practices that could create a new electronic agri-business with significant production, service and marketing requirements.

The productivity increases that are essential for international competition cannot be expected to be labour intensive. Indeed, many of the technological and economic trends such as robotics in agriculture and mining, and computerized farm management, can be expected to displace some employees. Yet in total, employment growth may be expected to remain firm from the following trends:

(i) expansion of resource production
(ii) provision of services to the new technologies
(iii) management of information within the prairies that was previously undertaken elsewhere.

Figure 14 **Computer Service Provision**



Concluding Thoughts and Issues

The evidence in the prairies does suggest that new technologies are having some significant effects on specific occupations within industries. Although the structure of the prairie economy and its related employment structure is only changing slowly into the 1990s, specific occupations are showing, and may still see, further substantial change.

At the macro level of major industrial groups, it is clear that there is not likely to be a wholesale disappearance of jobs in favour of automated machines. In aggregate there are strong pressures for new job creation associated with the new tech-

nologies, and will more than compensate for the reality of technological redundancy in specific occupations. This is apparent in the emergence of manufacturing and service opportunities to supply the new technologies, such as is now occurring in Saskatoon. It is also apparent in the creation of new employment opportunities in the computer service industry. In addition, new technology may allow manufacturing and service functions to decentralize from their traditional locations in eastern Canada.

The structure of the labour market is steadily shifting, however, towards services and information that contribute in increasing amounts, both directly and indirectly, to productivity and economic output. These developments raise numerous issues for employees, management and government.

Occupational Adjustment

The human impact of technological change remains the primary issue. At the individual level, macro-economic opportunities elsewhere in the economy provide little immediate solace. Retraining will remain a real option for many and requires more support within existing training institutions or companies. For many places of employment the introduction of new technologies need not require displacement, but rather the transfer of responsibilities. Finding ways to achieve such flexibility within current employment and management structures will be the major challenge.

Is the responsibility for retraining to be assumed within a company, by the individual, or the state? Can the risk for retraining be assumed through insurance, thereby providing resources for retraining periods? Can job descriptions and organizational strategies retain sufficient flexibility to accommodate retraining scenarios? How can unions accommodate technological changes that do not fit neatly within their organizations or member occupations? Technological change has been accommodated within many organizations with positive acceptance by employees. Chadwick notes, for example, that the large majority of insurance company workers that he surveyed looked upon technological change favourably, and reported that "advanced technology contributed more to their job satisfaction."[10] Under what conditions can such a favourable response be met? Do more radical joint ownership and profit sharing arrangements facilitate adaptation?

Economic Policy Adjustment

To date, the primary focus for prairie economic policy initiatives has been upon the development of new natural resources or the creation of manufacturing jobs. This approach to economic development policy becomes increasingly irrelevant, insofar as it neglects the real contributions that research, information and

communications make to the productivity of the economy, including the goods producing sectors. Thus, the traditional prairie policy objective for economic development that is diversifying into manufacturing, may be considered passé. Support for information services related to resource trading, research and communications can become significant contributors to output and employment growth.

It is important to note that the direct employment effect of producing new technology in the prairies is not large. In Saskatchewan, for example, where there has been significant growth of high technology companies such as Develcon, SED Systems and Northern Telecom, their share of employment amounts to only 1 percent. Most future jobs will not come from nurturing high technology enterprises based on computers or telecommunications satellites. The jobs are far more likely to arise from stuffing the new technology tricks into the old industrial structure. The issue for the prairies is how to apply these new technologies to some well established activities, often located in rural areas and less connected to the information centres of the technology. These are questions of applications research as well as information and technology transfer, often to rural areas. Without such development, however, the very real competitive threats that exist for the region's grain, mineral, forest and fuel exports can be expected to undermine prairie income and employment opportunities.

Within the prairies it might be considered that the economy was well placed to take full advantage of the new technologies. With less vested interest in the past than other more industrialized and institutionalized parts of Canda, and more than its share of the more adaptable small business, the region could move directly towards adopting the new skills given an adequate response to the human adjustment issues noted earlier. The co-operative movement has already gone a long way to achieving a model for increased work participation. The question remains as to how to best bring the region's high technology expertise to focus on the essential economic needs of the region.

Application of the New Technologies to Resource Industries

To date, new technology and information systems have seen their strongest application in the service and management functions of the economy. Although measures of service industry productivity remain limited, estimates suggest the productivity benefits of new technology are considerable.[11] Chadwick notes, for example, that actuarial output may have increased 6 times with the introduction of new technology.[12] Yet the resource sectors of the prairie economy may be critically threatened into the 1990s with competitive markets, low prices and restricted returns. In these circumstances there is an essential need for productivity

improvements. Although any advances in labour productivity may be expected to reduce employment in a sector, more jobs are likely to be lost from not applying new technologies than from short term technological displacement.

The application of new electronic information industries to the resource industries will require the combined skills of industry, government and universities on a sector by sector basis. This combined effort could cover such areas as farm management, agricultural marketing, irrigation controls, robotics and soil testing in agriculture, seismic measurement, robotics, environmental monitoring and market intelligence in energy, and mining and forest management technologies. Some advances are already underway in the form of video auctions and electronic software for farm accounts, demonstrating a capacity for rapid change. The potential for expansion has yet to be fully tapped, including robotics. Some special efforts will be required by the high tech community and the resource sectors, working together with the support of governments to establish their mutual and productive interests.

A Concluding Thought

Unemployment is the major issue in Canadian economic and social policy of the present time, and is likely to remain so for some time. The changes discussed here have related primarily to electronic, information and computer developments as they impact on the prairies. Yet, further waves of biotechnology and genetic engineering would seem likely to follow hard on present developments, and hold equal significance for the region's economy and jobs. *Technology* per se *does not lead to general unemployment.* It increases potential outputs from primary inputs. It commonly leads to sustained booms related to capital replacement or new product demands. There will be disruptions to the labour market, but there always are. The degree to which such disruptions lead to structural, long term economic disadvantage and unemployment, will be a function of competition in the market place and our willingness to adapt to changes that, once started, cannot be stopped. It is important that we not become so paralyzed with the potentially negative, though *not necessarily inevitable*, aspects of change, that we miss opportunities for growth. The findings from this review suggest that the outlook need not be cataclysmic, and that employees are interested in both change and improvements to the workplace.

It is inevitable that macro-electronic technologies will be used in areas of viable and commercial application. This will include the prairies. The process of economic development is, as Schumpeter[13] noted, an evolutionary process based upon creative destruction. Change is an essential ingredient of a growing econ-

omy and new technologies often underlie the change. The responsibility lies with those in the prairies to observe the changes underway, adapt them where appropriate to their interest, and effectively manage their affairs. Hopefully, the discussions that these findings generate will offer insights on how to improve that process, both within the management structures of organizations in industry, government, education and labour and between the high technology specialists and major resource industries that still provide the prairies' bread and butter.

NOTES

The views in this paper are solely those of the author and should not be taken to represent the positions or opinions of the Crown Management Board or the government of Saskatchewan.

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I should like to thank the members of the Human Resource Advisory Group of the Canadian Plains Research Center (CPRC) and Susan James of Saltec Consulting for the assistance, advice and research that contributed to the preparation of this paper.

V MANAGING HUMAN RESOURCES: A STRATEGIC CONTEXT FOR THE CHALLENGE OF NEW TECHNOLOGY

James Nininger

This might be called the Age of Anxiety. People are unsure, even apprehensive about the displacement caused by technological change and at the same time, hopeful and even enthusiastic about the quality of life promised by new technology. Unemployment in Canada will be high until the end of the decade, and it is necessary to rethink what "work" means in this country.

People want to know what to expect and when: are they going to be the beneficiaries or the victims of technological change? While it is counterproductive to be an alarmist, people should not be overly relaxed either.

As stated in my study of the Human Resource management of ten major corporations published in 1982, "Effective resolution of the impact of technological change will require the combined efforts of business, labour, government, education and other institutions." The approach to be taken should concentrate on effective *management* of human resources and technology. This management should not be equated with the *control* of people alleged by some trade union leaders.

What approach do we take in resolving technological change issues? It should be put this way because, whether or not technological change is impacting on any of us as of this moment, we can all be assured that it eventually will; and our readiness to cope, to adjust, and to compensate will make the difference between being victims or being beneficiaries. At the macro level consultative frameworks need to be developed, i.e. forums for the open sharing of different perceptions. At the micro organizational level a *strategic* focus is required in the management of human resources, a focus which asks these questions:

1) Does a well articulated strategy exist?
2) Are the relevant people informed about the strategy?
3) What does the strategy say about human resources?

In this context "readiness" means having the groundwork laid for joint problem solving between business, labour, education, and government. This groundwork can only be laid in an organization to the extent that it has a capacity for strategic planning through application of the following seven principles of human resource management:

Principle 1 There is an overall corporate purpose and the human resource dimensions of that purpose are evident.

Principle 2 A process of developing strategy within the organization exists and is understood, and there is explicit consideration of human resource dimensions.

New technology is the kind of issue which will have the appearance of being formidable and even frightening, when its actual application may be quite straightforward and have minor human resource consequences, and may even make the workplace a little more interesting. Without strategic planning, without readiness, however, it is also the kind of issue which will create tension and conflict in the cultural environment, in work attitudes and management practices.

In large bureaucracies, in particular, when new technology is the stranger in town it is sometimes a case of "shoot first and ask questions later."

Principle 3 Effective linkages exist on a continuing basis to ensure the integration of human resource considerations with the organizational decision making processes.

Being systematic, being proactive, being ready, means having concrete relationships which can be relied upon to assess new technology in a human resource context, determine the resources needed, and effectively communicate those needs to the major actors representing all vested interests. The Canadian Plains Research Center and its Human Resource Advisory Group is an example of the kind of concrete, multisectoral relationship that should be encouraged externally.

Principle 4 The office of the Chief Executive Officer provides the climate for integrating human resource considerations with the organizational decision making processes.

The lead role in cementing such relationships must come from the leaders of the community, whether it be the Chief Executive Officer (principle 4), the union president, the university president, or the cabinet minister. This level of commitment provides the rest of the organization with the climate and seriousness required to make such multisectoral activities functional.

Principle 5 The organization at all levels establishes responsibility and accountability for human resource management.

Accountability is key to being ready for and resolving such issues as technological change. This key is the line or operating manager. This is the vital link in any organization which permits continuing communication and understanding between people in the workplace and senior executive.

It is here where organizations must impress the seriousness and gravity of managers being alive to the fears and concerns of their staff when confronted with the possibility of significant new technology being put into place.

Principle 6 Initiatives in the management of human resources are relevant to the needs of the business.

The traditional role of the personnel function is simply inadequate in the face of widespread flux and change. The old reactive, regulatory, control function of personnel management is, by definition, incapable of considering and developing the kind of multilateral relationships now required where joint problem solving and planning is the order of the day. There will always be a need for the "fire brigade" because we cannot anticipate everything, but there must be a role for the visionary, for the planner who thrives on juggling a host of social, political, economic and technological variables into a coherent future, or alternative futures, through which organizations may venture. This requires quite a different mind set from traditional administrators whose survival instincts insist that one find out what senior management is thinking, and then feed it back to them as their "solution."

Principle 7 Included is the responsibility to identify and interact in the social, political, technological and economic environments in which the organization is and will be doing business. This principle is probably the key element to strategic human resource management in the context of the challenges of new technology. This means that organizations must incorporate a scan of the total environment within which they operate as an integral part of their human resource and corporate planning processes.

It has been shown in recent years that quantitative human resource planning does not work, and it does not work precisely because of the kind of change issues which new technology and innovation raise. We do not deal with a static world where people can simply be given their proper numerical identification and filed away, never to be heard from unless a grievance or discipline problem appears. People do not behave like mathematical equations. We need a behavioural orientation and a grip on the trends in the world about us in order to make our human resource management practices sensitive and strategic to the realities of that world.

Our analysis of technological change may find, for instance, that there are countervailing trends at work at the same time: new technology can delete jobs, create jobs, and maintain jobs — all at the same time, and even all within the same organization. The same technology, say word processors, can result in clerk typists losing their jobs or, alternatively, can make their jobs more interesting and creative.

Because we are largely a nation that thrives on exports, we are also a nation constantly in danger of losing our competitive edge. Therefore, a steel mill which is updating its technology even while it is laying off employees, can actually be maintaining a large number of jobs. "How?" you might ask. If that new technology is not developed and implemented, the entire mill would be in danger of losing its ability to compete and hence, closing down. This results in the loss of direct jobs and of many other jobs in secondary companies which depend on the existence of the steel mill. The ball does not stop rolling there. By not adopting new technology in a steel mill, by way of example, we eventually lose jobs in the service, financial, and real estate sectors as well.

So often, when we ask whether we can afford the human cost of implementing new technology we must also ask if we can afford the human cost of not doing so. Any human cost, however, can and should be ameliorated by a strategic planning approach to human resource management within and without our organizations, whether they are in the public or private sectors.

In the final analysis, we are all driven to be change agents by necessity. Our dynamic, changing environment dictates it. It must be kept in mind that the task of change agents with a strategic bent means that they must strive to establish multilateral linkages if they are to cope with technological change effectively.

Other similar work has appeared since my study of 1982 which provides further evidence of the need for a strategic mind set in approaching such ever present issues as technological change: *The Third Wave*, *Megatrends*, *In Search of Excellence*, and the Science Council's *Planning for an Information Society*. These are broad pieces of work which do not discuss the particular circumstances of any one region such as the Canadian Plains. The initiative of the Canadian Plains Research Center is more than appropriate for bringing human resource issues into focus for people in the places where they live and work. More of this sort of initiative is needed in Canada, particularly where it has a strong multilateral flavour.

VI NEW TECHNOLOGY? WHAT STRATEGY FOR THE PRAIRIES?

Greg Mason

Introduction

For years, provincial ministers of economic and industrial development coveted steel plants. Why could not prairie provinces undertake to stimulate their economies by subsidizing investments in heavy industry? In turn, it was argued this would secure "high quality" and stable employment. If the particular industry was well chosen, forward and backward linkages would also ensure further stimulating economic development.

Now the rhetoric has changed. Rather than steel plants, we speak of silicon chip production, and the most sophisticated talk about exploiting opportunities in software and hardware. There is a general frenetic trolling for the key sector which will produce the unique competitive advantage upon which to base economic development.

Recent reviews of industrial policy vary between those who argue that the state must become intimately involved in the partnership between business and government, and promote new technologies, and those who argue that the free market is the optimum way to choose "winners" and discard "losers."

In addition to concerns with industrial strategy, the state has also become very interested and aggressive in the supply side of human capital. Computer literacy is demanded by industry and educators, and the private sector has responded with a plethora of new programmes to encourage students to become versatile in the current computer technology. This growth industry is also seen by many as a key element in a high technology strategy.

This paper asks two questions. First, is it possible, in principle, to manage new technology on a global scale? That is, can we, collectively through government, make decisions about the direction, the adoption and the invention of new technologies? The second question relates to education. Are we overinvesting in training students for technologies which will become rapidly obsolete, and for which there is little prospect of widescale employment? Both of these questions are central to a technology policy for all governments but are crucial for governments in Manitoba, Saskatchewan and Alberta.

Industrial Strategy and New Technology

Industrial strategy, as it is usually formed, does assume a degree of activism on the part of government. If a province is to

adopt an industrial policy, there are several key assumptions which must be evaluated and accepted.

First, one must have confidence that the province can influence the course and pace of economic activity through its own fiscal policy, comprised of taxation and expenditures, and also that it is willing to undertake a procurement policy that may violate some rules of efficient government. With respect to taxation and expenditures, most governments have only about 10 to 15 percent of all expenditures which are "free," in that their alteration can be undertaken without legislative revisions. Also, most provincial finance ministers are decidedly conservative in fiscal stance, simply because of uncertainties surrounding the nature of their deficits and debt burdens. The general conclusion must be that an explicit policy for industrialization using provincial resources is limited indeed.

With respect to procurement, a province may elect to designate internal (to the provincial borders) suppliers, especially of new technologies, but this approach is limited severely by the size of the market available to the prairie producer. The only winner from this strategy might be Ontario. Producers from that region may eventually have such a significant cost advantage over producers located on the prairies, that fiscal prudence would dictate using those external sources of supply, and the internal policy would eventually have to be withdrawn.

Second, one must also accept that government can pick winners, and also that it ought to. This is particularly contentious. Neither the public nor the private sectors have a conspicuous and consistent success record in picking winners. For example, when General Electric reenters the computer industry to purchase a technology it sold a few years ago, it seems clear that the art of technological forecasting and strategic planning is still rudimentary.

Third, and related to the second point, is whether any government can put a sufficient "push" behind any idea, without other groups, both those within industry and those in other areas, pressing for similar support. This is exactly the same as the argument that no space research ought to be undertaken as long as there is one starving child anywhere. It is extremely difficult for any government to develop clear initiatives, and either explicitly or implicitly ignore certain key groups. This, more than the overall fiscal problem of government, seems to be the critical difficulty in developing an industrial policy. The fragmentation of government among various personal interest groups tends to inhibit decisive action.

A fourth assumption is that it is possible for the federal and provincial governments to agree and accept cooperation as a model for regional and industrial development. To date, this has

occurred less often than desirable. An example may assist to focus the discussion. In Manitoba, it is possible to discern three main areas of high technology initiatives. First, there are private firms operating in a variety of sectors such as aerospace, support services (e.g., printed circuitry) and medical technology. Second, there is the University of Manitoba with important work in the areas of micro-electronics, power engineering and the like. Finally, both levels of government have made individual forays. The provincial government has created a special facility for assisting entrepreneurs to develop innovations, and the federal government has initiated a series of National Research Centres, one of which is to be situated in Winnipeg.

It would be pleasant to report that these various initiatives were coordinated, but that is not the case. The gulf between university and private sector is extreme. Furthermore, the location of various public facilities supporting research, application and development is disparate. The provincial facility is remote from the university and the new National Research Centre is located in the core. The rationale for the placement of the latter was driven more by a consideration for urban redevelopment than stimulating technological innovations appropriate to the province. In fact, when the private sector is questioned about the desirability of locating high technology industries and research facilities in close proximity, some respond that this is the last thing they wish, for fear of losing trained workers to their competitors. Yet, the stories of Silicon Valley and the other areas of technological intensity, have one thing in common: namely, the close proximity of university, government and private sector facilities. Rather than discouraging the free flow of personnel between various groups, these areas maximize the potential for such cross-fertilization and develop a critical mass so essential for innovations.

Given these observations and assumptions, what ought to be the appropriate role of new technologies in the prairie region? First, it seems wishful to imagine that advances in basic science and important technical breakthroughs may occur in a region with a total population of some four million spread among five major cities and universities, without very close coordination and considerable selectivity of the problems upon which we are to concentrate. Furthermore, the close involvement of the public sector is essential.

Economists have developed the concept of "ruinous competition," and in the development of new technology there is great opportunity for throwing all the money down a black hole. Concentration upon a small number of probable areas of investigation is needed, as all would probably agree. The trick, however, is to undertake this coordination now and identify

indigenous specializations upon which further investments can be founded, and which will have a chance of success. To this end, provincial governments, federal agencies, universities and the private sector should immediately create the institutions required to initiate this coordination and plan the investments very carefully.

Although this may seem like a motherhood statement, in fact the process will be very difficult. Will it be possible to persuade the University of Manitoba to forego research into agricultural engineering (to take a hypothetical and, undoubtedly, unrealistic example) in order to let another university specialize in that area? Certainly, while many would find this far-fetched, the basic point is valid. If we are to pick the winners, we must also identify the losers and agree to swallow the medicine. If we are unable to undertake this coordination, then it is most unlikely that the prairie region of Canada will figure prominently in developing new technologies. It will also require self-discipline and trust to avoid protectionist policies by provinces, for this policy has great potential to snuff out any benefits from the new technology.

But, this is not necessarily all bad. If it is unfeasible to develop the degree of coordination to research and develop new ideas, then perhaps the appropriate course of action is to develop institutions which can *adopt* new ideas very quickly. Thus, in agricultural engineering, perhaps the role of the university and various government organizations is to encourage local manufacturers to incorporate new advances into their products. This approach would not require the regional cooperation of a more ambitious programme of original research and development. Another possible advantage is that this strategy allows smaller scale and more precise targeting of public investments. This is compatible with recently observed trends toward diseconomies-of-scale noted in manufacturing high technologies.

In summary, it is unlikely that the prairie region of Canada will be the locus of major new developments in high technology. This undertaking would require major changes in behaviour and political institutions — changes which would still not assure success. More feasible is specialization at local and regional levels based upon enhancing indigenous industry to adopt new technologies. This requires centres and institutions which are devoted to enhancing the diffusion of knowledge, namely the universities and demonstration projects where new ideas can be developed with comparatively little risk on the part of the entrepreneur.

Education Requirements for the Adoption of New Technology

Although it may appear to be a more conservative approach, the adoption of new technology actually requires a more

comprehensive form of education. Before developing this point, I would like to consider the entire subject of appropriate training for new technology.

Much of the current education and training in high technology is beside the point and a waste of time. Some educators, propelled by politicians, have undertaken a frantic curriculum revision to incorporate new courses in computer programming. It appears essential for any secondary school to have a full complement of computer courses to ensure that the present cohort of students is properly trained for tomorrow's labour market.

For the most part, these students will not participate in high technology, except passively. The vast majority will not use even relatively complex languages such as BASIC, since most user software in the next five years will be menu-driven and require the barest modicum of computer literacy. The fear of computers, and the myth that there is a "culture" which must be imbued at a young age to ensure success (like learning the piano or doing ballet) seems to have been perpetrated by an industry eager to cash in on sales of educational products and software. For the most part, the emphasis on computer literacy displaces other core courses from the curriculum and produces students who tend to approach the world as a series of black boxes.

An example assists in illustrating the danger from training a generation of *idiots savants*. VISICALC, a well known and powerful spreadsheet, has great potential for allowing an organization to develop scenarios and forecasts of future revenues and expenditures. Along with this power is significant potential for egregious error. Recently, some firms have reported serious errors committed by personnel using the spreadsheet, but without fundamental insight into the process they were forecasting. They treated the programme as infallible and failed to undertake error checking procedures to ensure that a mistake made early in a scenario would not multiply and produce serious errors. In some cases, these mistakes were not spotted until the financial planning process was well advanced, and then only because more experienced analysts thought the numbers looked "fishy."

The strategy of adopting new technology will require technical personnel trained in wide areas of basic and applied science. The present emphasis on narrow job related skills is myopic, and despite the statements made by some industry representatives, is not in the long-run interest of the private sector in Canada. To train students in computer procedures and protocols which are already obsolete (e.g., programming in BASIC) serves no interest, except those who need to demonstrate their commitment to technological training. Certainly, it does not serve the student. Rather, renewed emphasis on more traditional subjects, such as

mathematics, logic, language and other aspects of a "core" curriculum will serve as a more robust basis for educating those people who will have the ability to adopt new technologies, and will also serve those whose interest is more fundamental — namely, the development of new processes and basic science.

Summary

Our educational system presently reflects the underlying confusion in the policies we have toward new technologies. On the prairies, adoption of new products and processes should dominate public investment in the creation of infrastructure devoted to the development of these processes. The educational system should also devote the bulk of its resources to ensuring that the graduates are able to participate in the activity of adopting new technology, as well as providing them with the basis for further more specialized training. Certainly, there will be serendipitous inventions, and new processes and products will be developed in the prairie region. But, in an era of fiscal restraint public funds and efforts at coordination will have to concentrate on more modest goals than the leading edge.

VII

THE BOTTOM LINE:
DISTINCTIVE SOLUTIONS FOR THE PRAIRIES

John G. Lynch

As the manager, with primary responsibility for human resource management in my company, my day to day and long term concern is to find and/or train the human skills needed to operate a very large and very complex enterprise. It is necessary to ensure that we provide systems and an environment that permit people to excell, to perform as effectively and satisfyingly as possible. In addition, because Petro Canada is owned by the people of Canada, we have an explicit mandate to act so as to reduce labour market problems. These could be the inequities faced by women and minorities, the unemployment problems of the young and many regions of Canada, or the need for adjustment to, and optimization of, technological change.

From that perspective the management of technological change commonly encounters skepticism as an issue. As Claude Taylor, the chairman of Air Canada, has described, "We've all heard and said so much about the so-called technological revolution and how it will surely transform the ways we work and live that many of the words have lost their meaning or their immediacy." As we try to wrestle with the broad, philosophical issues involved in fundamental change, we are less likely to feel "future shock" than we are a vague sense of what could be called "future tedium."

The forecasts abound, with their implicit assumption that in the future, instead of growing food or finding oil or building buildings, the vast majority of us will be employed in the manufacturing of micro-chips, or the application of them to as yet unthought of industrial processes. Most wonder if those prophets have really ever looked at the reality of the prairie economy.

From the practical perspective of a very large oil company let me suggest the following:

1. The degree to which new technologies will be developed here in the prairies will be limited. Developments will, by and large, take place in areas of existing manufacturing and technological excellence. While there may be significant developments in the Saskatoon area, for example, the bulk of our future jobs will not be found in future factories manufacturing high technology equipment.

2. The greatest opportunities to benefit from, and participate in, the so-called technological revolution will lie in the application and adaptation of basic technologies developed elsewhere to our particular conditions and, above all, to our basic industries — agriculture, oil and gas production, mining — and perhaps potash mining in particular, and some aspects of transportation including grain transportation and electrical transmission.
3. The immediate and longer term results of this modernization of our basic industries will be reductions in direct employment from current levels. In the medium and longer term, however, these losses will be more than offset by growth in the service sectors that will benefit from the greater prosperity of basic industries that become more competitive in international terms.
4. Finally, if these perceptions are accurate, the greatest need is for more effective links between those areas and industries where technologies are being originated, and the basic industries that are the foundation of our prairie economy.

The immediate solution is, therefore, the development of more effective mechanisms for technology transfer and adaptation. Some mechanisms are already in place. The Micro-electronics Research Centre at the University of Manitoba, funded by both federal and provincial governments, is unlikely to develop a new generation of micro-chips. But it can explore and extend the applications of that powerful technology in the prairie setting.

Petro Canada, and other companies in the oil industry, are working actively to find and to apply technology to the unique circumstances of the prairies. The refinements and improvements being made in the non-conventional oil area, in heavy oil and tar sands, represent significant technological improvements and may well lead to spin-off industries, manufacturing equipment or otherwise exporting the knowledge we gain.

The main mechanism of technological transfer in the past in Canada has been the multi-national manufacturing firm. The prairie economy is less marked by such firms than other parts of Canada. Accordingly, if we go running off in all directions in search of new computer factories that will locate in Brandon or Moose Jaw or even Saskatoon, then we will be missing the real opportunity that exists for the prairie region. The prairies will be successful only if we realize that our "high technology industries" must be our agricultural industry, our oil and gas industry, mining, and the other strengths our economies already have.

There are some other myths about technology I think we could

usefully put behind us. One is that technology replaces unskilled labour. That has already happened just about as far as it will happen in the short term. There may be more warehousing jobs lost to robots, and hazardous jobs that will be automated. Increasingly, technology is going to replace skilled people.

Some of the most highly trained people in agriculture are those who grade grain for the National Wheat Board. And one of the most promising applications of technology to agriculture lies in the electronic grading of grain. It could be faster. It could be cheaper. It would certainly involve fewer jobs for these highly trained people.

The other myth is that technology will usually be easy to use. Anyone who has bought a home computer or had a terminal installed in his or her desk knows that is not so. The prairie wheat farmer — looking at the vast improvements that technology has brought to herbicides, and faced with the choice of weed specific, pre-emergent, post-emergent or pre- and post-emergent herbicides, knows that analyzing the costs and benefits of what used to be fairly straightforward business decisions is far from simple.

The prairies have one very good example of a unique application of technology developed elsewhere in the Grass Roots Videotex service. Telidon technology was developed in central Canada — but its first and thus far only successful application has been in the West, where it provides a means of communication ideally suited to the geographically scattered nature of agriculture. We need to be on the lookout for other such applications and adaptations.

What are the distinctive solutions to technological change we should be looking for on the prairies?

1. There is a need to focus efforts on the development of the linkages needed to ensure rapid and effective transfer, application, and adaptation of technology to basic industries. Nobody can predict with certainty what the spin-offs in terms of other employment and other opportunities will be. It is a certainty that increasing world-competitive industries in western Canada will lead to spin-offs.

2. Both the enterprise sector and government must be alert to opportunities as they arise. It will be necessary to re-orient a little — from a concentration on solving our own problems, to a greater sensitivity to opportunities for selling our solutions to the world.

The prairies will not become a vast western Silicon Valley. They are positioned to have the technologically most advanced basic industries on earth. And that building on our existing strength will be the key. Implicit in that strategy is the need for

flexibility in the way we plan and organize our training efforts and resources.

I am skeptical that a comprehensive long term strategy can be drawn up, beyond a focus on identifying and responding to opportunities or problems as they arise. What is required are improved linkages between the enterprise sector and public training and education facilities. It will not be good enough to set up a curriculum for a community college or a university, print up the calendar, and plan to review it somewhere down the road. As adjustments in skills are called for — and these will be perceived first in enterprises across the prairies — mechanisms are required to permit the re-deployment of training and educational resources in very specific and responsive ways.

VIII CONTINUING EDUCATION: THE URGENCY FOR SKILL LEAVE

Lenore Rogers

Following the passage of the National Training Act in July of 1982, Cabinet requested the Minister of Employment and Immigration in consultation with the Minister of Labour, to examine the need for education and training as a tool by which working Canadians could ensure their continued employability in the face of technological change. Consequently, the Honourable Lloyd Axworthy, then Minister of Employment and Immigration, initiated a three-stage process of which the report, *Learning for Life*, is the culmination.

The prairies and Canada need to look at the development of a comprehensive training and re-training policy. Comprehensive means a programme that is available to *all* workers and that provides adequate time and income for people to engage in learning of their choice.

The skills and capacities of the working population represent one of the largest contributions to a country's productivity. To be able to respond intelligently to growing mountains of information and to develop the critical thinking skills of selection, interpretation and synthesis will be highly prized. In addition, the skills needed in the future will be the development of interpersonal skills and the mastery of the basic skills of literacy and numeracy. There will be an increasing value on flexibility and adaptability.

Education should no longer be seen as the first step in a process of learning, working and then retirement. Instead, work lives should be interspersed with training and education throughout a lifetime.

The urgent need for action to develop a lifelong learning policy is generally agreed upon. But the need for further debate and a process of consensus-building on how this will be done needs to be tackled by all of us. The National Panel on Skill Development Leave recommended a two-stage strategy:

1. Recommendations for immediate and urgent action
2. Actions to be taken by 1986.

Prior to reviewing recommendations it is important to keep three considerations in mind:

1. *Letting the Learner Choose* No central authority is likely to be able to predict the nature of future job opportunities. This suggests that choices regarding skills acquisition should be made by *Canadian adults themselves*, thereby reducing the risk to the individual, and

to the economy, of centralized errors. In this new environment, the best investment will result from letting the adult Canadian choose the content of the learning.

2. *Consultation and Collaboration* The inter-connected nature of the various elements of an educational leave policy necessitates active and constructive consultation among the key parties involved as part of the process of developing specific measures and ensuring their effective implementation.

3. *All Sectors Share Resources and Co-ordination* The successful development and implemenation of an educational leave policy, and the enjoyment of the resulting benefits, will touch all sectors of Canadian society including federal and provincial governments, business, labour, education and voluntary sector. This obligation to bring resources to bear on this critical opportunity is shared by all these groups, although the nature of their contribution will vary according to the particular circumstances at hand and the measures being implemented.

No sector can afford to stand back and wait for further developments in this area before engaging itself in the task at hand, hoping that others will carry the responsibility. The special role of each sector, and the far-reaching nature of educational leave, make it imperative that all sectors share the resources and co-ordination needed to make the venture successful.

Recommendations by the National Advisory Panel

Stage One: Urgent Action To Be Undertaken Immediately

1. Endorsement by the federal government of the goal and principles of "Canada As A Learning Society"; ratification of these principles by the provinces and endorsement by all relevant sectors.

2. The establishment of new federal and provincial government programmes to provide support for the educationally disadvantaged.

3. The development of Canada Employment and Immigration Centre (CEIC) programmes to enable immediate re-training of those threatened with job loss or skill obsolescence without loss of income and the strengthening of labour codes to provide appropriate notice.

4. The establishment of Education Delegates in the workplace to link the learners in the work force with local counselling and training opportunities.
5. The institution by the federal government of an exemplary programme of educational leave in the federal jurisdiction and to encourage similar action by the provinces.
6. The accelerated removal of barriers to learners.
7. A national process of planning and consensus-building. This could include the establishment of a representative, Federal-Provincial Council of Educational Leave, to work toward implementation of Stage Two recommendations.

Stage Two: Action To Be Undertaken by 1986

8. After negotiation and national discussion, legislation by the federal and provincial governments to implement a universal programme for educational leave without loss of income. Such a programme would be accompanied by a major publicity campaign, a "Finish High School" programme and complemented by a Registered Educational Leave Savings Plan.
9. The establishment of Local Training Councils, changes to Canada Employment Centres (CECs) and "Experimental Community Employment Centres," in order to better connect learners, needs and opportunities at the local level.

Education and training are emerging as the most critical issues with respect to technological change and the development of high technology industries. The recent debate on post-secondary education has focussed largely on fiscal issues and governments have become more preoccupied with income support and job creation than with training programmes. As a result, policies and programmes do not seem to be addressing adequately the urgent needs for more technical training or more re-training programmes and for joint efforts in this area with industry.

Useful findings from the report in relation to the conference "New Technology: Challenge and Change in the Prairie Labour Market" are:

1. *Re-training Those Threatened With Job Loss and Skill Obsolescence* This recommendation was put in place because it was felt by the panel that there was some degree of urgency to deal with this issue. Designated employees who have been told by their employers that

they may become redundant in the forseeable future, would receive special treatment. Designated employees would go on a four-day work week with the fifth day being used for re-training.

The employer would pay for the four days, maintaining benefits for the fifth, while the Unemployment Insurance fund would pay the full salary for the fifth day. Wherever possible, the employees should be trained for future jobs available in their current places of employment. Otherwise, re-training should be for skills in local demand, or, at the very least, basic skills lacked by the employees and required for further training or greater career flexibility. Legislative provision in all labour codes would require notice of redundancy to be strengthened and provide appropriate notice to employees to allow time for re-training.

2. *Education Delegates* Education delegates would be elected by employees at each workplace to act as education representatives to discuss education and training matters on behalf of employees with management and to perform as a channel of information to employees concerning counselling and training opportunities that are available in the community. Information to workers is sorely lacking at the present time. There are certain levels of employees — i.e. supervisory and above, that generally speaking, have access to educational leave initiatives provided by their employers. If all employees earned the right to time off, the same as they presently do with holidays, and they had access to the information of which educational programmes are available, employees would take advantage of these programmes. Business supports the concept of education delegates to provide employees with information about training and counselling; however, they oppose legislated rights.

3. *The Need For Consultation, Discussion And Negotiation Among Sections* A mechanism should be set up whereby hearings can be held under federal/provincial auspices in order to fully discuss the idea of skill development leave or paid educational leave among all sectors — business, labour, education and the voluntary sector.

The new Canadian Labour Market and Productivity Centre should be given a special role in collecting and distributing accurate local, regional and national information on the supply of and demand for labour, and on projected perceived skill gaps. This would permit

good local counselling, planning and training programmes and enable all sectors to collaborate on the basis of shared information.

4. *Programme for Universal Educational Leave* A programme needs to be designed with the input of all sectors. The panel felt that the objective of a programme for universal educational leave would be to:

4.1 enable all adults in Canadian society to acquire and maintain, throughout their lives, the skills, knowledge and ability to make a contribution to society and pursue a life of fulfillment and good citizenship, and,

4.2 provide adequate time and income for all who have made a contribution to Canadian society to engage in learning of their choice.

The panel believes the federal and provincial governments should enact legislation to provide all Canadian workers with the right to earn time off to take leave for education and training purposes. Leave could be earned at the rate of, for example, one day for every thirty days worked (some members preferred a rate of one day for every twenty worked; others preferred one day for every fifty days worked) and such a leave should be legislated for all workers. The cost for this programme would be picked up jointly by a surtax on personal and corporate income.

In my experience, business is generally against any legislative right to paid educational leave. A Regina small business suggested that if the business required a secretary to be re-trained as a word processor operator, then that training should be provided at the place of employment. The concept of the worker having the right to get the training that the worker felt was important was not supported. Business does a great deal of training already. Yet, the Canadian Association of Adult Education shows that people who already have high levels of educational achievement are the ones who participate in continuing education. If, as a country, we are going to have a highly skilled work force, it will require all our human resources — not just those at the top.

5. *Local Training Councils* The panel recommended that federal and provincial governments in consultation with representatives of industry, labour and education establish local training councils to plan and co-ordinate programmes to meet local needs. The councils would oversee and advise upon counselling services required in the community. They would also arrange for appropriate training programmes to meet local needs.

6. *Major Publicity Campaign* Experience in other parts of the world, specifically in Europe, shows that even though they have educational leave policies in place, the uptake by the employees is not very high. The panel believed that the federal government in concert with the provincial government should launch a "participation"-like media campaign to convince Canadians that they need to engage in lifelong learning, periodic or recurrent education and/or re-training if they are going to remain employable in the future.

Conclusion

The panel presented their report to the Honourable John Roberts in March of 1984. Since that time, there has been a chance to reflect and study the issues even further. In retrospect, it appears that the panel geared their thinking toward the idea of having a readily trained labour force in order to meet market demands. But in the future, there may not be sufficient jobs for all people. Perhaps jobs are not the only way we can redistribute income. Instead, there may need to be income security plans. This redistribution of funds should go to individuals to ensure that they are flexible to meet their own and the country's future needs, rather than propping up the traditional industrial base that may eventually be phased out in light of rapidly changing technologies.

Present income support systems such as Unemployment Insurance should develop people rather than maintain them. That is, policies should allow people to re-train while on public assistance programmes. In the long run, people will be more productive and reduce the cost to the state. A broad answer to human resource planning in light of technological change is training and education.

IX PRIVATE SECTOR HUMAN RESOURCE DEVELOPMENT PROGRAMMING

W.N. Toombs

The issue of human resource development in the face of technological change on the prairies has been one fraught with opinion, procrastination, debate, politics and an increasing sense of urgency and frustration. Those in the labour force, particularly those who are unemployed, are realizing that in order to compete for jobs, and in order to survive, they must have the knowledge and skills to cope with rapidly developing technology.

Young people view with skepticism current pre-employment education and training as prerequisites to job acquisition. The taxpayer is concerned about the relevance of the programmes in their educational institutions. The politician, feeling the heat from constituents, reacts by looking to alternatives for the deployment of the education dollar. The educator is increasingly frustrated by the pressure of fund reduction and by the demand for programme change.

Their comments provide another opinion on the subject of human resource development by attempting to answer three questions:

1. What are the dominant needs for education and training arising out of the emerging trends in the community?
2. What characteristics should such human resource development programmes take?
3. Who should assume responsibility for such programmes and their delivery?

Changes in technology have had an impact on the workplace. Robotics, computers, communication devices, new materials and techniques have all changed what workers do on the job. All of these changes have created, in uneven ways, differences in how we relate as people one to another. Human relations skills — and communication skills — need to be examined and learned as never before.

As the "information float" disappears, as people become more knowledgeable, as more leisure time becomes available, people are exercising more and more control over their lives in the community and, more particularly, in the workplace. Hence there is pressure for organizations to function in smaller units. There are increasing incidents of management and labour designing the

form and substance of a company together. And there is an increasing need for skill development throughout the working life of people.

Two dominant themes affect educational and training needs in our prairie community. The first is a need for a general education in order that a base for coping with change and for communicating be established. This category includes preservice training for trades, technologies and the professions. The second theme relates to the need for continuing education to upgrade our general knowledge of the world and its activities, to advance special leisure time interests and to accommodate changes in the workplace.

The critical task ahead is to define more explicitly the roles and relationships of each of the public and private sectors in education and training. One of the errors in the current view of public postsecondary education is that it should attempt to be all things to all people throughout their lives. The private sector, in the past, has expected and received trained manpower — human resources educated at public expense. To assume that these resources should be prepared for specific tasks in specific companies is too unrealistic. To assume that the public sector should provide lifelong training is equally wrong.

The task of providing continuing education and training for work must fall on the shoulders of the businesses and industries requiring the specific skills and knowledge. The ensuing advantage such on-the-job training provides to production is obvious. More than that, the specific company can better define its own training needs and can more readily construct programmes to satisfy those needs. If some of the major corporations are to be believed, the benefits of such on-site training go beyond the acquisition of skills to a highly beneficial involvement of employees in determining the very course of the company itself.

How much of this is being done on the prairies? A Canadian Plains Research Center study afforded the opportunity to determine the extent to which training is occurring in five major prairie corporations. Interviews were conducted with human resource managers in Canterra and Norcen, both of Calgary, IPSCO in Regina, James Richardson and Sons in Winnipeg and The Canadian Co-operative College in Saskatoon.

Common to all of these companies were the following:

1. an optimism about development of the human resource training programme in the future
2. a relative lack of human and fiscal resources to undertake the task of training, reflecting, in part, management attitude to human resource development

3. an emphasis on programmes dealing with human relations, particularly in the area of supervisory skills
4. a tendency to look to outside programmes and instructional staff in the area of technical upgrading
5. a response to technological change determined by immediate needs
6. a lack of involvement of the human resource development unit in middle and long range company planning
7. an informal relationship established with public sector educators.

There are, no doubt, many corporations, particularly larger ones on the prairies, which have more advanced training units. But if the ones studied are any measure of private sector activity in human resource development, then a great deal more has to be done.

If it is accepted that the private sector has a responsibility for on-site training and re-training of its human resources, if it is agreed that the public sector institutions perform a preservice role and if it is agreed that a great deal has to be done to provide for the impact of technological change, then how are these roles and responsibilities to be carried out more effectively?

The following actions are recommended:

1. A joint corporate-public sector study of the roles and responsibilities of each in human resource development should be mounted. Such a study should indicate those areas of education and training which are the exclusive domain of each; those areas in which joint action should take place; and the mechanisms and strategies to be designed to promote such joint action.
2. The private sector should seek ways in which its own training and re-training capabilities can be improved. This activity requires the involvement of people — management, employees, experts — and needs the necessary funding.
3. Each of the partners in the provision for human resource development needs to continue to establish strong relationships with each other. Each should know more of the educational activities of the other; each should know more of the needs and capabilities of the other.

X MEETING THE CHALLENGE — SOME CONCLUDING COMMENTS

Alex Curran

It is an interesting experience to act as moderator for a series of workshops in which the subjects are interesting, the participants knowledgeable and the debates stimulating. It is even more interesting when the moderator must also attempt to summarize, at the end of the seminar, the key issues emanating from each of the workshops. Under those conditions it is really impossible to summarize in a fair and impartial manner. I make no apology, therefore, that the conclusions which I have chosen to stress have been selected with a personal bias.

At the seminar our task was to understand the impact of new technology on the economic and social fabric of the prairie region, and to accept the implied challenge to mould the impacts for desirable results. The prepared presentations had been selected to identify the major areas of impact, they were well researched and provoked discussion in the workshops.

From these discussions came proposals for action. The proposals emanated from a basic premise — high technology will continue to make progress, it will have an increasing impact upon what we do and how we do it, hence it is desirable that we in the prairie region take steps to participate in, benefit from and exercise a degree of control over the applications of high technology which will affect us.

Building on this premise the participants concluded that high technology initiatives in the prairie region are now, and will continue to be, characterized by five factors:

1. The key to success is the economic application of new technology to existing industrial processes, products and services.
2. The applications should be rooted in the basic industries so that there can be a strong partnership between new and established economic thrusts.
3. There is a strong thrust for local ownership of high technology companies in the prairie region.
4. There is already a history of entrepreneurial attitude which results in the creation of new companies. The universities have been active in fostering this attitude.
5. High technology industry cannot survive on the prairie market alone, it must use its local market as a base to compete globally.

With these characteristics in mind, the participants identified a number of guides to action.

First, on the prairies, we shall become even more service-oriented in our technological applications. This will make us susceptible to productivity improvements in that sector, and hence, will lead to employment disruption in the near term. Nevertheless, by becoming more competitive on the national and international levels, we shall maintain existing jobs in the medium term and create more job opportunities in the long run.

It is recognized in the prairies that we must become much more professional in the development of human resources. Too often the negative consequences of technological change on people in the workplace are taken for granted, or else dealt with after the fact when much of the harm has already been done. Strategic, proactive approaches can and should be taken in the management of human resources.

Furthermore, so long as rapid change occurs, people must be prepared for continuing education, for lifelong learning that assists them in adjusting to new work situations and careers. That implies a change in responsibilities for formal education, perhaps leading to a greater share of the financial burden of postsecondary and continuing education being borne by corporations and individuals. In order to give people the opportunity to obtain the necessary continuing education, educational sabbaticals should be offered by the place of employment.

Despite the steady growth of the prairie economy, it is not matched by a commensurate growth in job opportunities. We do not want to revisit the Klondike gold rush. That was another example of the creation of wealth without the creation of jobs. It was organized to reward only the individual entrepreneur; but then, as now, there was not enough wealth to allow everyone to be an entrepreneur. In the workshop, we heard a demand for the control and creation of wealth to be fair and equitable. The co-operative cultural heritage of the prairies must not be lost.

We need a vehicle for telling and sharing success stories, where people have met the challenge of rapid technological change and created a "win-win" situation for all concerned. Is this appropriate for media outlets on the prairies? If so, there also needs to be an identified source of such good news stories.

Clearly, we are all in this together as a community. It is a great opportunity for broad-based problem solving and decision making that must involve the cornerstones of prairie society: government, education, labour, and industry. As good citizens of the prairie community, we must reduce the adversarial role and posturing between the cornerstones and put all our efforts together.

All the foregoing strikes me as a highly productive display of effort from the frank and pragmatic discussions enjoined at the

workshop by representatives of the four cornerstones.

However, there were two areas which I was disappointed were not more bravely addressed by the participants. First, although there was a recognition of the need to change the educational system, and a further recognition that this will require multipartite consensus and action, there were no volunteers to initiate and focus the process. We need a champion, a group of risk takers who will initiate the necessary action, however controversial. The alternative of doing nothing is an unacceptable endorsement of current inequities, fraught with too many inefficiencies and uncertainties.

Secondly, this was a *regional* conference but there was no pressure to recognize that the whole is greater than the sum of its parts — that there might be greater economies and efficiencies if we shared resources and opportunities across the prairie region. Regional concerns were raised — such as the disruption of shift programmes from one university to another, or the concern over the size of the domestic market — but the participants did not suggest any mechanisms for intra-regional problem solving and sharing.

Yet, overall, the workshop was a significant contribution to a working knowledge about the impact of new technology on the prairies and about the means necessary to make that impact as positive as possible. The efforts of the Human Resource Advisory Group at the Canadian Plains Research Center have borne fruit. I congratulate Evelyn Jonescu and Ken Alecxe on their display of leadership in making this workshop happen. We have achieved a much better understanding of the issues on the prairies. People have been challenged. Now the risk takers, the agents of change, must take the challenge to mould the impacts of high technology to achieve the results we desire.

Epilogue

KEY ISSUES AND OBSERVATIONS RAISED BY CONFERENCE PARTICIPANTS

Ken Alecxe

This report will briefly summarize the key issues and perspectives on new technology as developed by a cross-section of the conference participants and compiled by R. Long, M. Chadwick and J.R. Jowsey. Not all of the issues, perspectives, or insights raised by the participants are contained in this report; however, the conference organizers felt that it would be useful to the reader of these proceedings to have a reasonably representative sample of the reactions of the participants raised in the small group discussions following the keynote presentations.

The first issue deals with possible threats posed to women in the labour force, particularly by various types of new office "automation" or information technology. It was noted that outside of traditional "women's professions" (i.e. teaching, nursing) most female employment is concentrated in clerical and office jobs, where a variety of routine information transmission, manipulation, and storage roles are performed. These jobs are the ones most seriously threatened, in the short run at least, by new office technology, and can be expected to decline in proportion to "knowledge jobs," which involve origination, interpretation, analysis, and usage of information. Currently, most "information workers" are female, while most "knowledge workers" are male.

A major need then is to help women who will be potentially displaced from their "information" jobs make the transition to "knowledge work." This will require the creation of "bridging" positions in organizations, and the provision of opportunities to acquire the particular learning, education, and experience necessary to make the transition. In short, a well defined "career path" out of dead-end and soon-to-disappear jobs is essential, but this has yet to be developed in most current organizations.

On a more positive note, the majority opinion is that, although the possible threat to employment is real, the impact to date has been minimal, as many organizations which have implemented the new technology have taken their productivity gains to improve quality of output, to produce new and/or better customer services, or to generate new customers, rather than eliminating staff. Thus, although time may be short, there is time to make the necessary adjustments if they are started now.

A related issue is the concern about the potential for fragmentation, deskilling, computer monitoring, and pacing of informal

work. While these consequences may possibly occur in some instances, it was the experience of participants that the introduction of new office technology frequently had the opposite effect, with routine aspects being automated and a restructuring of jobs to include tasks requiring greater use of skills and ability. For one participant the introduction of new office technology provided the impetus for a restructuring of tasks that not only produced a higher level of organizational effectiveness, but also a higher quality of working life. However, to bring this about it was essential to provide training to managers and implementers in socio-technical principles and to allow work group participation in the formulation of the new system.

Another issue of major concern is how new technology could be used to help decrease the current high unemployment rate among young people. Two ways were identified. First, better career and job opportunity information should be provided. Electronic means pose the potential for both more accurate and timely projections and forecasts, and can also facilitate collection and dissemination of information about current job opportunities. Employers themselves have a large role to play in improving information quality.

Second, the new information technology could be used to connect potential young entrepreneurs with needed information and resources. An illustration of how this might work is provided by the "Thames Technet," a programme sponsored by the City of London, England. Under this programme, would-be entrepreneurs can approach one of four regional centres, which provide limited office and workshop facilities and, most importantly, access to a computerized data base of relevant resources. For example, an individual with an idea for a business or service would be able to identify potential resources that would help him further explore and/or implement the idea. For example, he might be able to locate a college professor of marketing who has offered his skills and services relevant to this topic idea, a retired engineer who is willing to assist with product design, or a former entrepreneur who understands various aspects of getting a business started. Of course, potential partners or employees might also be located. In short, the purpose of the "Technet" is to facilitate the normal entrepreneurial process by identifying and investigating opportunities more efficiently than normally possible.

A final issue discussed is the role of technology with respect to education. Two implications were identified. First, what implication does the advance of new technology have for the *content* of education? Although no definitive answer emerged, it was clear that the educational system must produce people with generalized thinking and analytical skills in order to provide the flexibility required to adapt to the constantly changing nature of jobs in an information society, rather than focussing on producing overly

specialized and narrow skills and knowledge. Thus, the groundwork must be laid for an on-going education. However, equally important is the development of certain values and ideals that will allow society to control and shape the new technology for humanistic purposes, as well as training in how to effectively interact on an interpersonal basis.

The second major implication is related to the *process* of education. Clearly, if used effectively, the new technology offers a variety of potential benefits, but a major one is the ability to deliver greatly improved learning opportunities outside of the constraints of hours and place imposed by the normal classroom. This could greatly assist the process of providing continuing education and retraining to those already in the work force. A final point raised is that the educational process should encourage all students to have access to all types of learning opportunities, particularly "knowledge work," as defined earlier. Although much remains to be done in this area, progress is being made, as evidenced by the fact that at least half of the graduates of many business and management schools are now female.

In sum, participants believe that the new office technology presents as many opportunities as it does threats, but that these opportunities will not be optimized without support from a variety of actors.

First, business and management must work to implement the new technology in ways that enhance human abilities, rather than the reverse, as Dr. Nininger implied in his presentation. To accomplish this will require a greater development of knowledge and awareness among management of relevant principles (such as socio-technical systems) and actual examples of positive and negative usages of the new technology. They must also be willing to involve the relevant users/employees in the planning and implementation of new technology. The participants firmly believe that enough evidence exists to show that the appropriate usage of new office technology can enhance both organizational effectiveness and quality of working life.

Second, business and organized labour were singled out for typically operating in an adversarial as opposed to co-operative or collaborative mode. This approach essentially limits the potential for maximizing the common goals of all concerned (e.g., increased productivity, 'full' employment, meaningful work, etc.). In turn, issues such as job re-design, job re-structuring, job sharing, shorter work weeks, multi-skilling, job rotation, and educational leaves were identified as reasonable alternatives to traditional and current employment practices.

The implication is that all interest groups will have to alter their present expectations and attitudes and work with, as opposed to against, their counterparts in order to achieve solutions

which are satisfactory to all. It was further pointed out that given the co-operative historical roots of the prairie region, responsibility and decision making with respect to human resources and technological change must be shared, fair, and equitable.

Also, some participants observed an over-emphasis in small group discussion on planned development, *vis à vis* John Seel's reference to the fact that there may soon be fewer middle managers and more control of decisions in the hands of upper-level managers through new technology applications. This, in turn, may lead to even greater alienation of lower-level employees in their attempts to improve techniques or working conditions, and may ultimately lead to an abandonment of the effort expended in trying to influence the decision makers. Consequently, the upper-level managers must become more flexible in their dealings with employees.

Just as managers will have to be more flexible in changing their traditional approaches to management and dealing with employees (as many progressive firms know and practise), the union will also have to become more flexible as well. For example, it may be necessary to break down hard earned but rigid job definitions, boundaries, and work rules in order to allow the reorganization of those tasks and jobs required for the positive use of the new technology. As well, payment based on knowledge and skill level, rather than the particular job or task performed may also be necessary to promote the needed flexibility. Related to this process will be the development of a relationship of trust and respect between the parties, which will not develop if one or both parties feel threatened.

Third, as discussed earlier, the education sector must evaluate itself to be sure that it is providing the base for lifelong and continuing learning, including the analytical skills and values necessary to guide humanistic development and social control of the new technology. Universities and other educational and research institutions must also continue to generate specific knowledge about experiences and evidence regarding the positive and negative usages of the new technology, and transmit this knowledge to key decision and policy makers in all sectors, especially to management and labour, as well as to the general public.

Finally, governments can play a major role in facilitating positive and humanistic application of and adjustment to the new technology. This may involve the supporting of knowledge generation (research) and information dissemination (e.g., through publications, teaching and consulting) in these areas. It may involve activities to get the other major actors to coordinate their activities and work together, including generation of an appropriate labour-management relationship. It may act through the development of various policies to promote retraining,

re-education and effective identification of career and job opportunities. Finally, it may involve usage of legislation and other means to control certain potentially negative and destructive uses of the new technology, and to ensure the appropriate and equitable distribution of the benefits stemming from the new technology.

In general, there is recognition for the need to develop better transitional mechanics for both short and long term occupational shifts caused by technological change. However, additional research would be required prior to developing and implementing any strategies. In particular, it was suggested that the CPRC might undertake research in the following areas:

a) determine what the attitudes of labour (both employed and unemployed, organized and unorganized), business, education, and government are regarding technological change and associated issues and concerns

b) determine and identify barriers to the implementation of advanced technology in the prairies

c) identify the perceived roles and responsibilities of labour, business, government, and education with respect to human resource planning and technological change and associated issues and concerns.

It is felt that such research would be necessary as an initial step in the process of developing and implementing subsequent strategies and actions.

Other issues associated with technological change and human resource planning on the prairies include the realization that our regional economy, although based on agriculture, mining, and oil, is still largely dependant on 'small' business which has limited organizational resources to deal with change, particularly in the areas of training, education, and alternative work designs. In short, small business is ill-prepared to deal with change from a variety of perspectives when compared to larger corporations and institutions.

As well, it is generally agreed that, in many instances, advanced technology has become an end in itself, and that by confusing the ends with the means technology may come to be the prime determinant in designing the prairie human resource landscape as opposed to being a tool for effectively improving our way of life. The participants also conveyed a feeling of a lack of control over this very complex issue (perhaps a more appropriate descriptor would be a complex of issues).

In closing, following are some of the issues which participants feel were not identified in sufficient depth during the proceedings, or were only dealt with obliquely. First, whose responsibility is it

to counsel, further train, and fund those young persons who have invested two years of their lives and substantial amounts of their families' income in order to pursue post secondary education at either a technical institute or university supported by public funds — only to discover that there is no regular employment available related to their training? Whose responsibility is it to counsel such persons and/or direct them into developing a new or challenging secondary skill, which will at least bring them some satisfaction, if not major financial support? This point was touched upon by Dr. McClaren in his identification of the education basics: the arts as a media of expression, and social studies as the development of a sense of community. It was not, however, developed in any great length.

Finally, the problem remains that while various speakers made some reference to standards of *values*, they were no more specific than that. Hence, what are the values of compassion, caring or community that people on the prairies espouse? Having identified such values, how do we integrate them into our day-to-day behaviour? How do we advance these value systems in our organizations, our personal relations, our working relations, and in the manner in which we approach such vital issues as coping with the advent of new technology?

Gordon Currie

Mr. Currie has had a distinguished thirty-five year career as an educator and as a prominent figure in the sports community. In 1979, Governor General Edward Schreyer presented Mr. Currie with the Order of Canada, the highest award a Canadian can receive for service to his or her community.

More recently, in 1982 Mr. Currie was elected a Member of the Legislative Assembly for the Regina-Wascana constituency. He was named Minister of Education and Minister of Continuing Education in May, 1982. In July, 1983 he was appointed Minister of Telephones and Minister responsible for effecting the creation of the Department of Science and Technology. In January, 1985 he was assigned the additional responsibility of Minister of the Department of Advanced Education and Manpower. Currently, Mr. Currie is Legislative Secretary to the Department of Advanced Education and Manpower.

John Seel

John Seel is an experienced entrepreneur who has developed and managed two successful firms. One has helped a variety of authors use computer technology and the other has assisted them on publicity tours. He has served as national director of Product Education for the Dimack Corporation of Dallas, and has lectured widely on college campuses.

John Seel brings to the Naisbitt Group extensive knowledge in historical and social dimensions of cultural change. Mr. Seel now serves as Senior Associate in Client Service Division which aids corporations in identifying and responding appropriately to developing trends.

Milton McLaren

Milton McLaren's background is in the area of arts, education and biological sciences. In 1967 he was appointed jointly to the Faculties of Science and Education at Simon Fraser University.

As a member of the Faculty of Education, Dr. McLaren is now coordinator of the graduate programme in Education, an interdisciplinary programme operating between the Faculties of Arts, Interdisciplinary Studies, Science and Education. He is also Director of the Learning Resources Centre which is responsible for the development and assessment of educational technologies and for the training of educators in the use and application of computers, telecommunications and video systems to instruction.

Graham Parsons

Graham Parsons's background and experience is in the field of economic analysis. Since 1967, he has held various positions in

this area in Ontario, in London, England, and now in western Canada. Dr. Parsons has been on faculty at both the University of Manitoba and the University of Saskatchewan, and more recently has held senior positions in the Department of Regional Economic Expansion, the Potash Corporation of Saskatchewan, and the Ministry of State for Economic and Regional Development.

Graham Parsons was also recently director of Economic Analysis for the Crown Management Board, Province of Saskatchewan, and is currently Secretary of Economic Policy for Executive Council.

James Nininger

Before joining the Conference Board of Canada, Jim Nininger was on the faculty of Queen's University School of Business. In addition to teaching and administrative duties, he was involved in a consultation and research capacity with a number of public and private sector organizations in Canada, the United States and Europe. His primary area of specialization has been human resource management, particularly with reference to the relationship between human resources and strategic planning.

Dr. Nininger joined the Conference Board in 1976 as director of the Compensation Research Centre. He served in a number of capacities on the Board until 1978 when he was appointed President. At present, he is a member of the Policy Analysis Committee of the C.D. Howe Institute, serves on the Advisory Council of the Queen's University School of Business, is a director of the Council for Canadian Unity, and is director of a number of other organizations.

Greg Mason

Since 1974, Greg Mason has been on staff in the Department of Economics at the University of Manitoba. From 1977 to 1978 he was an advisor to the Manitoba government on economic development matters. In 1981 he became the founding director of the Institute for Social and Economic Research at the University of Manitoba.

Currently, Dr. Mason is principal investigator on the MINCOME (Manitoba Basic Annual Income Experiment) Data Base Design Project at the Institute. He is founding editor of the Western Economic Review, an economic and public policy journal focussing on the special concerns of the western provinces.

John Lynch

Prior to joining Petro Canada in 1982, John Lynch worked for a major oil company in Toronto and Calgary where he was in charge of the human resource function. In addition, he has several years' experience in the pharmaceutical industry as a manager of organizational development.

John Lynch's area of specialization is organization planning and design. Mr. Lynch is now Vice-President of Human Resources for Petro Canada Incorporated in Calgary.

Lenore Rogers

Lenore Rogers was recently a member of a national advisory panel on skill development leave. This panel recommended a number of policy initiatives and developed the report "Learning for Life: Overcoming the Separation of Work and Learning."

Ms. Rogers has held positions with the Canadian Mental Health Association and the Saskatchewan Labour Women's Division. At present, Lenore Rogers is Coordinator of Business and Industry Programmes at Regina Plains Community College in Regina. In that capacity her responsibilities are liaison with the business community to develop appropriate training programmes, and supervision of a CEIC-funded project to develop a bridging programme for women.

Will Toombs

Will Toombs has a combination of public and private sector experience in the field of education. In the late 1960s, he was Superintendent of Schools in Moose Jaw. He was on the faculty of the University of Regina for eleven years during which time he was Associate Dean and Dean of Education. In 1978-79 Dr. Toombs took a sabbatical in London where he studied the open university and delivery of post secondary programming. In 1981 he was Deputy Minister of Continuing Education, Government of Saskatchewan.

For the past three years, Dr. Toombs has been in the private sector as a consultant in human resource development.

Alex Curran

Alex Curran has been employed with the Canada Department of Communications (Assistant Deputy Minister, Space Programme), with Northern Telecom (Assistant Vice-President, Technology Planning), and with Bell Northern Research (President of Bell Northern's California subsidiary).

Presently, Mr. Curran is president and chief executive officer of SED Systems Incorporated in Saskatoon.

Ken Alecxe

Ken Alecxe has worked as a policy analyst with various departments in the Saskatchewan government, including the Departments of Social Services, Labour, and the Public Service Commission. He is Chairman of the Human Resource Advisory Group as well as being on the Board of Directors at the Canadian Plains Research Center. He is a founder and a member of the National Executive of the Canadian Human Resource Planners.

Currently, Mr. Alecxe is Director of Strategic Planning, University Affairs Division, Saskatchewan Advanced Education and Manpower.

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NEW TECHNOLOGY

The second of two conferences organized by the Human Resource Advisory Group of the CPRC was held on October 29-30, 1984 to address the theme of "New Technology: Challenge and Change in the Prairie Labour Market."

Conference participants representing government, industry, educational and research facilities assessed the impact of new technology on the prairie economy and work force.

Future educational needs and new options for management and labour were addressed from both the local and global perspectives by workshop contributors.

In identifying the trends and options facing the prairies these papers provide a significant contribution to the study of human resources and technological change.

Kenneth J. Alecca is Director of Strategic Planning, University Affairs Division, Saskatchewan Advanced Education and Manpower Department and is the Chairman of the Human Resource Advisory Group, CPRC; Graham Parsons is Secretary, Economic Policy, Policy Secretariat, Executive Council, Government of Saskatchewan.

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